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ORIGINAL MEMOIRS.

ŒSOPHAGOPLASTY.

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IN cases of inoperable carcinoma of the thoracic portion of the œsophagus, the old methods of gastrostomy (Witzel, Kader, Ssabanejew-Frank, Senn) should be resorted to, as they are not serious operations and their functional results are good.

However, if the tumor in the œsophagus is to be extirpated, the mere establishment, for feeding purposes, of a fistula below the costal arch, is nowadays no longer a sufficient procedure. The whole operation, including the making of the gastric fistula, should be planned with a view to reconstruction of the œsophagus—"œsophagoplasty," viz., the making of a tube which will enable the patient to swallow his food and pass it down into the stomach.

Lexer and Frangenheim each succeeded at about the same time in giving a patient with impermeable cicatricial stricture of the œsophagus extrathoracically a new, useful tube by a series of plastic operations. (1910–11.)

Both employed the combined methods of Roux and Wullstein who exclude and then transpose under the skin of the chest a coil of the jejunum, of which the lower end is con-

nected with the gastric fistula and the upper end with the oral stump of the œsophagus by a skin-plasty.

Next to the necessity of the seriatim operating, the threatened necrosis of the transplanted jejunal coil represents the weak point of this otherwise ingenious procedure.

At this stage of the evolution of the subject in question, it meant real progress when Jianu proved by a number of successful operations upon dogs that the major curvature of the stomach can be used for the formation of a tube, of which one end remains in connection with the gastric fundus, while the other free end can be brought up under the skin of the thorax to a point not far from the clavicle.[1] Before him others had tried to solve the task in a similar manner, Depage [2] making use of the lesser curvature; Hirsch [3] of the anterior wall of the stomach.

Not long after the publication of Jianu's article, Roepke tried the method for the first time on a patient with cancerous stricture of the œsophagus, and it proved a perfect success.[4]

In December, 1912, a female patient, forty-six years of age, came under my care at the German Hospital who had found increasing difficulty in swallowing for the last six months. A sound showed a stricture nine and one-half inches behind the incisor teeth, and the X-rays revealed the presence of a stricture involving several inches. Œsophagoscopy was difficult on account of abundant salivation and mucous accumulation in the œsophageal pouch above the narrowed lumen. In view of the contemplated resection of the œsophagus, Jianu's method of gastrostomy, which represents the first stage of extrathoracic œsophagoplasty, appeared clearly indicated. The operation was done on December 26, 1912, the procedure of Roepke being followed pretty closely, as follows:

[1] Gastrostomie und Œsophagoplastik. Deutsche Zeitschrift für Chirurgie, vol. 118, p. 383, 1912.

[2] Résultats d'une nouvelle méthode de gastrostomie, x French Surg. Congr., 1903.

[3] Plastischer Ersatz des Œsoph. aus dem Magen. Centralbl. f. Chirurgie, 1911, N. 48.

[4] Centralblatt f. Chirurgie, No. 46, November 16, 1912.

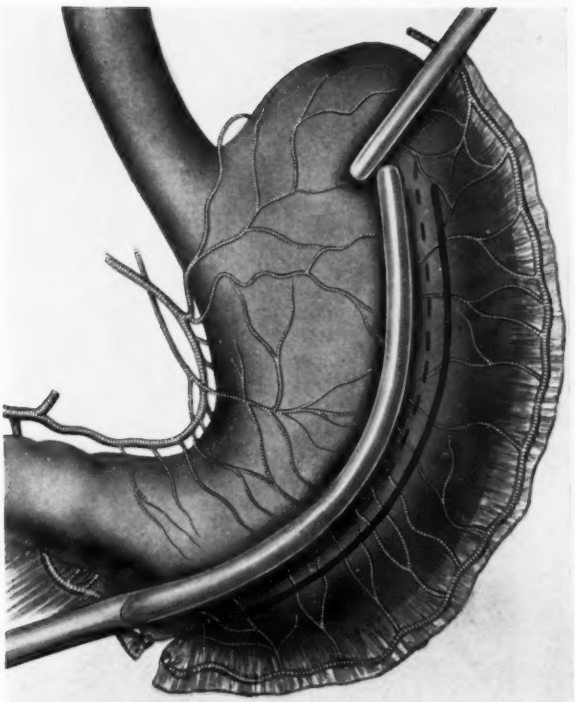
After exposing the stomach by a median incision from the xyphoid process to the umbilicus, tying off the major omentum up to the place where the left inferior gastro-epiploic artery turns on to the stomach, and after double ligation and division of the right inferior epiploic artery about two inches from the pylorus, a mattress suture of silk was run through the entire thickness of the stomach about one and one-quarter inches distant from and parallel with the greater curvature (Fig. 1, dotted line), the stomach having been lifted up by the assistants in order to have the contents run toward the lesser curvature. This part of the operation could have been simplified had a suitable clamp, better still two clamps, corresponding in shape to the major curvature, been at hand. (See Fig. 1, which is taken from Jianu's article.) In placing two equally shaped clamps alongside of each other, parallel with the major curvature, the asepsis of this part of the operation can be materially improved (see further down).

The thread of the mattress suture was clamped close to the fundus of the stomach opposite the last ligature of the greater omentum, and then an incision made through the stomach along this suture. (See Fig. 1, dark line.) The portion of the stomach thus dissected was temporarily wrapped in a piece of sterile gauze. Then a second continuous silk suture, commencing again at the major curvature, inverted that part which had been closed by the mattress suture, so that the width of the stomach was reduced to about two-thirds of its normal size. After this second thread had reached the place where the mattress suture had been clamped before, it was knotted to this and then continued as a Connell stitch up to the tip of the stomach flap, transforming the latter into a rather wide tube which connected with the fundus. (Fig. 2.) It was provided with a good blood supply and covered all around with peritoneum. A second continuous seromuscular suture was added alongside this new tube, as is done in gastro-enterostomy. The length of the new tube was 25 cm. (9¼ in.).

Thereupon the stomach, thus mobilized, was turned so that the base of the tube was lying at the upper end of the median abdominal incision, right below the xyphoid process. Placed upon the surface of the thorax, the free end of the tube easily reached up to the cartilage of the third rib, without any stretching of the tube. Over this cartilage, about one inch to the left

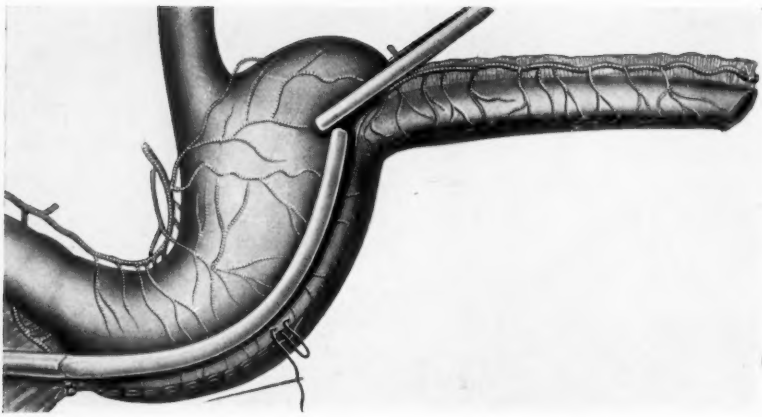
border of the sternum, a horizontal incision 1½ in. in length was now made, down and through the fascia of the pectoralis major muscle, the fibres of the latter bluntly divided and a tunnel bored below the muscle with a large curved clamp. With the tip of the latter, when it emerged into the upper end of the abdominal wound, were caught the threads (left long) of two inverted sutures, which had been placed in order to temporarily occlude the tip of the newly formed tube, and drawn up and out of the upper chest wound, until the occluded tip of the tube projected for about half an inch. Now the abdominal wound was properly closed by sutures, the upper ones catching the stomach on their way, thus lifting it up, and the end of the new tube opened up by cutting the two inverting sutures, and fastened to the borders of the small chest wound. (Fig. 3.) Of course, this opening of the tube might be done twenty-four to thirty-six hours later, as, for instance, with the sigmoid in inguinal colostomy. However, with proper care asepsis can be nicely maintained and it is better for patient and surgeon, if the work can be finished at the time of the first operation. In this case the asepsis was disturbed later on by a fascia necrosis, due to gangrene of the seromuscular coat of the uppermost extremity of the new tube, the gangrene having been caused by fastening the tube in place with through and through sutures, which evidently constricted the vessels. This proved to be a technical mistake. In view of the fact that the nourishing vessels enter the new tube in a horizontal direction, its seromuscular coat should *not* be surrounded by the sutures which have to anchor the top end of the new tube. *The mucosa alone* should be lined to the borders of the skin wound. Nevertheless, the patient was up and about on the ninth day after operation; she was presented before the New York Surgical Society on the twelfth day, Jan. 8, 1913. (See ANNALS OF SURGERY, Transactions of the New York Surgical Society, April, 1913, No. 4, pp. 586 and 587.) So far the intended thoracotomy could not be done on account of a perichondritis of the rib cartilage and also of the border of the sternum, to which the submuscular suppuration had spread. Meanwhile the patient enjoys full diet, the food, after thorough chewing and salivation, being deposited in some kind of warm fluid and then washed down into the stomach through a funnel. Weight is slowly increasing. She permanently wears a large sized rubber

FIG. 1.



Major omentum has been divided (proximal ligatures are not shown in illustration Right inferior epiploic artery doubly ligated and divided. It is wise to clear about three-fourths to one inch of the major curvature of the stomach toward the pylorus of omentum plus vessels. (This step, also, is not brought out in the illustration.) In the case reported no clamps were placed, but only the mattress suture (dotted line) which shut off the new tube from the rest of the stomach. The heavy black line represents the direction in which the scissors divided the stomach. (Taken from Jianu's article.)

FIG. 2.

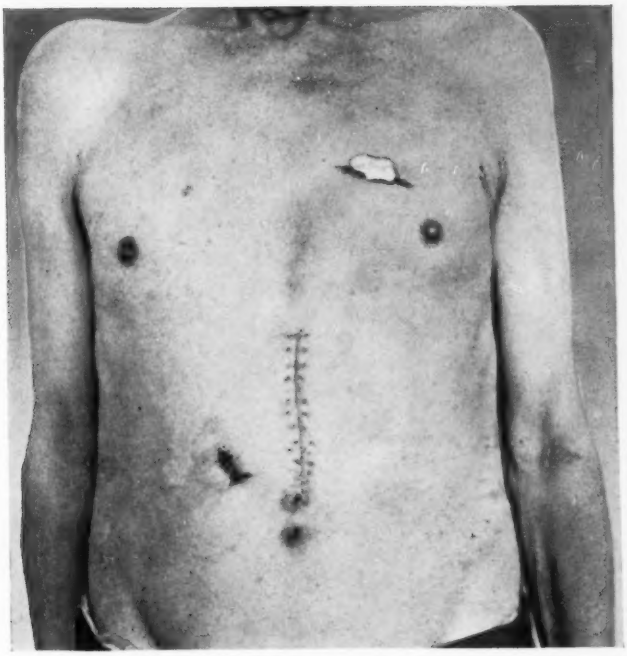


"Jianu tube" turned up; the second row of sutures (Lembert) is placed; note the splendid blood supply and pointing upward of the proximal portion of the major omentum which, after transposition of the tube to the outside of the chest, points to the right side of the patient. The one end of the tube remains in connection with the fundus of the stomach; the free end represents the gastrostomy opening, which eventually can be sutured to the ower end of the transposed oral stump of the œsophagus, after resection of the intrathoracic carcinoma has been accomplished. (Also taken from Jianu's article.)

FIG. 3.

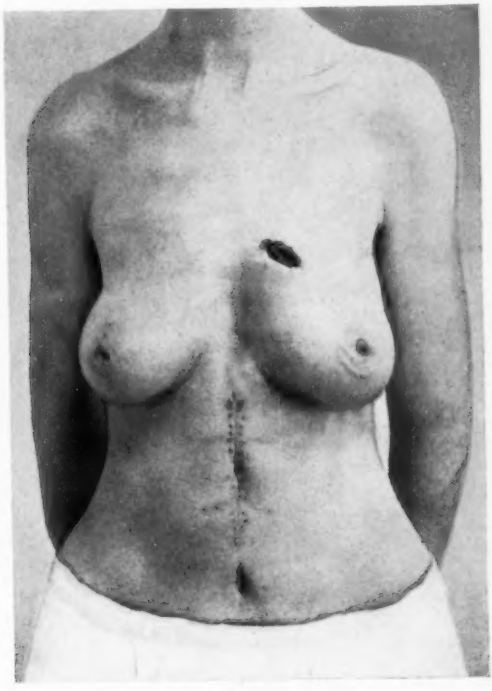
Photograph of the first patient, forty-six years old, who was operated upon at the German Hospital according to Jianu-Roepke's method on December 26, 1912, as described in this article.

FIG. 4.



The second case, male, sixty-eight years old, operated upon at the German Hospital, March 24, with the help of Hültl's wire stitching instrument.

FIG. 5.



Third case emale, forty-one years of age, also operated upon with the help of Hültl's instrument on March 27, 1913.

tube within the Jianu-tube because the latter—also in consequence of the sub-muscular suppuration—developed a leak in the line of the continuous silk suture.

Ordinarily it will not be necessary for the patient to wear a rubber tube; a small piece of dry gauze will close the Jianu opening between meals. If this is not satisfactory, either a permanent tube can be worn, with the outer end plugged, or, as our observations have shown, the tube may be compressed with a piece of gauze held down by a strip of adhesive plaster placed across the chest. A truss-pad, filled with water or glycerine, held in place by straps around the thorax, will answer the same purpose. The new tube communicates freely with the fundus of the stomach. Regurgitation of food and stomach secretion can occur, producing excoriation of skin.

On basis of operations on dogs, we have recently made use to great advantage of Hueltl's wire stitching instruments in the formation of the Jianu tube in two patients, March 24 and 27. The operation on the stomach is thereby rendered absolutely dry and, of course, more aseptic; the time of the operation is also shortened. Both patients were operated upon with the help of intravenous ether anæsthesia and are doing nicely. In one the new tube is 19 cm. long (Fig. 4), in the other 21 cm. (Fig. 5.) In both the gastrostomy opening corresponds to the level of the third rib. In one of them I could have easily placed it level with the second rib, had I put the tube on the stretch.

With regard to the question of the subpectoral or subcutaneous placing of Jianu's tube, I feel inclined, even with the limited experience thus far had, to favor the subcutaneous way, for, though usually the operation will run an aseptic course, a local infection may nevertheless occur, and in that event it will be easier to cope with the subcutaneous than with a submuscular seat of inflammation. Besides, the latter may spread to periosteum of rib and sternum, or the perichondrium of the ribs, which always means a tedious convalescence.

Furthermore, since recent developments have shown (Ach's patient living 17 days after resection of the œsophagus, Torek's first successful case of resection of the œsophagus for a carcinoma behind the aortic arch) that the subcutaneous transposition of the oral stump can be done also in the human being without endangering nutrition, it would seem an advantage to have both tubes, the œsophageal stump from above and the Jianu tube from below, meet on the same level, for if they should not be long enough to make end-to-end union possible, a skin plasty would have to be done.

In thinking over this plan of operation, the question has arisen in my mind: How shall we proceed if the first stage of œsophagoplasty has been done by Jianu's method of gastrostomy in a case of carcinoma of the œsophagus with the idea of resecting the tumor in the second stage, and the case is then found inoperable.

It seems to me it would be advisable in such an event, nay, even indicated, to go ahead, same as we do within the abdomen in the case of an inoperable carcinoma of the pylorus. Here we do a gastro-enterostomy to alleviate the patient's misery. We tell his relatives the true state of affairs, but he believes—at least for a time—that he is cured; a palliative, humane treatment.

The greatest hardship for patients with malignant œsophageal stricture is their inability to swallow. Their principal desire is to have this restored. Why not then, if on thoracotomy a case is found inoperable, divide the œsophagus proximal to the tumor and invert the distal end. Then transpose the oral stump under the skin of the neck and chest and, if long enough, unite it with the opening of the Jianu tube. If it proves too short, a connecting rubber tube (Gluck, Perthes) will re-establish swallowing of liquid and semifluid food. If this should prove unsatisfactory, a skin plasty will have to be made to bridge the defect and thus complete the extrathoracic œsophagoplasty.

Even in cases where the tumor apparently totally ob-

structs the œsophagus, there is usually still sufficient drainage through a narrow and tortuous canal in the centre of the tumor down into the stomach, same as Madelung's operation (division of the sigmoid, inversion of the distal end and implantation of the proximal end in the abdominal wall) has shown the practicability of this method in cases of inoperable rectal carcinoma.

Further experience and observation is needed to find out how long the transposed oral stump of the œsophagus may be without becoming necrosed. It certainly is of the greatest importance for the patient's future, that partial gangrene with the ever-occurring subsequent phlegmon of the surrounding tissues should not set in.

In cases, in which examination previous to operation shows the cancer to be located between the aortic arch and the cardia, or right at the cardia itself, then, it has been my recent practice in animal experimentation, assuming this condition, to bring up the tube *intrathoracically,* through the foramen œsophageum of the diaphragm into the pleural cavity, and to make an end-to-end anastomosis between it and the oral stump of the œsophagus. (Intrathoracic œsophagoplasty).[5] A patient cured by this procedure would live on after the operation the same as he did before he became afflicted with the cancer. The only drawback of this latter, seemingly ideal procedure is, that according to present indications, the entire work has to be done in one sitting, whereas in extrathoracic œsophagoplasty Jianu's operation can be done in the first sitting and resection of the œsophagus with transposition of the oral œsophagus stump in the second. Perhaps a way can be worked out experimentally how to make the intrathoracic œsophagoplasty also a two-stage operation.

The introduction of Jianu's operation, comprising as it does, the first stage of extrathoracic œsophagoplasty—very likely also the possibility of carrying out intrathoracic œsophagoplasty—appears to have advanced by another great step the surgery of the œsophagus, which is now making headway by leaps and bounds.

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[5] Centralbl. f. Chirurgie, February 22, 1913, No. 8.

SOME SURGICAL FEATURES OF INJURIES OF THE SPINE, WITH SPECIAL REFERENCE TO SPINAL FRACTURE.*

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THE LESSER INJURIES TO THE SPINE AND THEIR SIGNIFICANCE.

INJURIES to the spinous and transverse processes and laminæ are very frequent, and not a few of the conditions that are ordinarily called "sprains of the back" are really fractures of part of a vertebra, or rupture of a vertebral ligament. The many joints and bony processes surrounded and held together by strong ligaments, and the surrounding muscles, are the explanation for the remarkable strength of the vertebral column and its resistance to injuries. But the peculiar structure of the spine offers also many opportunities for fractures, for rupture of ligaments, etc. For several years I have been having X-ray pictures taken of the spines of patients who had sustained slight injuries of the back, and have been surprised by the frequency with which a fissure or fracture or part of a spinous process or tip of a transverse process has been found. These comparatively slight injuries usually cause no symptoms besides the local pain and tenderness; there is, perhaps, some stiffness of the back, and the symptoms are soon relieved by rest and simple remedies. A week or two after such an injury, the patients seem to have fully recovered, although for many months they may have some backache when they arise in the morning. We do not know, however, how often such a slight trauma may be the starting point of a long drawn-out spinal disease, of a hæmatomyelia, a syringomyelia, or one of the spinal glioses or scleroses—

* Read before the Springfield Academy of Medicine, February 12, 1913.

those diseases whose origin is still enshrouded in darkness and whose nature is but ill understood. Slight trauma of the spine may be a very important factor in the etiology of many spinal diseases.

RUPTURE OF SPINAL LIGAMENTS.

Rupture of a spinal ligament is a very frequent injury, and one to which much too little attention has been paid in the past. The most important ligaments in this connection are the ligamenta subflava or flava, which bind together the laminæ of the vertebræ and thus contribute to making a complete canal for the spinal cord. After slight injuries to the back I have seen, in two instances, very severe and perplexing symptoms arise. Both patients had sustained an injury to the back of so slight a nature that they only spoke of it when closely questioned, both suffered from what was at first supposed to be a severe sciatica which had resisted prolonged treatment. In both patients the X-ray showed that there had been an injury to the bony spine, in both the laminectomy revealed a ruptured ligamentum subflavum; both were entirely relieved by the operation.

Case I (reported in detail in *Surgery, Gynæcology and Obstetrics,* March, 1913).—Mrs. C., forty-nine, thrown out of automobile ten months before. Severe pain over distribution of the fourth lumbar spinal root on the left side. X-ray shows thickening of arches of fourth and fifth lumbar vertebræ. Laminectomy, June 25, 1912, showed that the left lamina of the fourth lumbar vertebra had been fractured and the ligamentum subflavum torn off and rolled up so as to make pressure on the fourth lumbar posterior root. Excision of ligament and division of thickened posterior root was followed by complete and permanent relief.

Case II.—M. C., twenty-two years of age, admitted to the service of Dr. Bailey at the New York Neurological Institute in February, 1913. Eighteen months before, patient was thrown out of grocery wagon when his horse ran away. He landed on his back and several boxes fell upon him. For three or four days he was unable to sit down on account of pain in the but-

tocks but otherwise felt well. Six months later he began to have intermittent cramps in the left leg, and the leg soon became stiff. Pain became constant after several months and he would feel it down the back of his leg to the heel. The pain interfered much with walking, and was made worse by exercise. No other symptoms.

Physical Examination.—Left knee and ankle jerks slightly exaggerated, slight diminution in sensation over distribution of third and fourth lumbar roots on the left side; slight stiffness of entire left extremity, tenderness on pressure over sciatic nerve. X-ray shows evidence of an old lesion between the fourth and fifth lumbar vertebræ.

Laminectomy (February 13, 1913).—Removal of spines and laminæ of second, third, and fourth lumbar vertebræ in usual manner. The laminæ, and especially the fourth, were much thickened and the spinal canal much narrowed. The cauda was bent backward at an angle and the dura was reddened on its inner surface at the spot of greatest angulation. All of the thickened bone was removed and the left fourth lumbar root divided.

Convalescence uneventful. Patient was discharged relieved of his symptoms on March 1.

Both of the above patients had undergone a prolonged treatment for sciatica. The X-ray made the clinical picture clear, and showed us that we had to deal not with a nerve but a radicular symptom.

It is possible that among the cases that are grouped as sciaticas, there may be some in which the symptoms are due to a spinal lesion, as in my two patients; in these, operative interference with removal of the pressure upon nerve-roots is indicated, and should be followed by immediate relief.

FRACTURES OF THE SPINE.

Fractures of the spine occur most often either in the mid-cervical (fourth to sixth cervical) or the lower dorsal (eleventh, twelfth dorsal, first lumbar) regions. In the cervical region, the spinal canal is large and the vertebræ are freely movable upon each other, while in the dorsilumbar re-

gion the canal is relatively narrow and the vertebræ more fixed upon each other.

The importance of a fracture of the spine—and for the sake of brevity I shall include under this head all severe injuries to the vertebral column which are ordinarily described as fracture dislocations, no matter whether there is a fracture with or without some dislocation or a dislocation with or without some fracture—lies not in the fracture itself but in the injury that has been done to the spinal cord. Whenever the treatment of recent fracture of the spine is under discussion, we always hear most conflicting opinions—some claiming that a fresh spinal fracture should never be operated upon, others being equally emphatic in their statements that all or most spinal fractures should be subjected to operation. The supporters of this latter view base their belief upon the fact that if irremediable injury to the cord has been done, the operation will not make matters worse. Let us consider both sides of the question.

Fractures above the fourth cervical vertebra are usually followed by death, either at once or after a few hours, from injury or compression of the medulla, and are therefore never cases for operation.

In what other patients is immediate operative interference justified or imperative? Unless the patient's condition is so poor that any interference is contra-indicated, I believe that an operation is called for when we have evidence that there is compression of the cord by bone or blood or when there has occurred considerable contusion of the cord. Operation is indicated in all of these patients if the symptoms of a cord lesion are not well marked. By "not well marked" or "incomplete" symptoms of cord injury I mean symptoms from which one may conclude that there are still numerous pathways up and down the cord unaffected—there is only a partial loss of power below the level of the fracture, sensation is well preserved over considerable areas below the level of the lesion, many of the reflexes are preserved, the control of the bladder and rectum is little or not interfered with.

In those patients with "incomplete" cord symptoms, an X-ray examination should be made as early as possible, in the patient's bed, and evidence of bone pressure thus obtained. A lumbar puncture should be done at once, for this will show us whether there is a large amount of blood in the dural sac. If the X-ray fails to show any marked bony deformity, and the lumbar puncture reveals little blood within the dura, then we may be fairly certain that the symptoms are to a great extent due to a contusion of the cord.

Now a contusion of the cord is soon followed by an œdema of a very destructive nature or by bleeding into the spinal substance. The œdema is very apt to cause, within a few days, a complete and irremediable transverse lesion of the cord, but its spread can be prevented by the decompressive effect of the laminectomy, to which may be added a direct incision into one of the posterior columns of the cord near the posterior median septum (Allen). A small collection of blood within the cord substance may be safely withdrawn by means of aspiration with a fine needle, and the formation of a hæmatomyelia cavity in the cord prevented.

You may ask, where is the pressing need for operation in these patients with "incomplete" cord symptoms? Is it not better to wait and see how the case will progress? It is true that from the standpoint of danger to life, no hurry is necessary. But our aim should be to have, if possible, a perfect functional recovery. The constant pressure of bone will cause degenerations in the cord which can never be recovered from, the same is true of intraspinal blood clots, and I have already spoken of the danger of œdema of the cord. Most satisfactory results can be obtained by early operation—complete recovery of function—and good but incomplete recoveries follow late operations. In experienced hands, the danger of a laminectomy is small. The operation can be done very quickly—under local anæsthesia if necessary. In this connection, I want to relate the history of a patient who recently came under my observation, who might have been saved if early operation had been performed.

Mrs. H., sixty-four years of age, the mother of a physician, was seen by the writer on the evening of February 1, 1913. The previous night the patient tripped and fell down stairs, striking upon her back. She at once complained of severe pain between the shoulder-blades and said that her legs felt weak, although she was able to move them. Examination by several physicians showed that there was a fracture of the spine at about the sixth cervical vertebra, patient was able to move her arms freely, although she complained of some pain shooting down the arms; she could move her lower limbs somewhat and the knee-jerks were preserved; sensation was lost below the level of the umbilicus.

The case was not considered one for operative interference. The symptoms steadily grew worse, so that when I saw her the anæsthesia extended up to the neck; there was complete loss of motion and sensation of the lower limbs and trunk, and almost complete loss of power in the upper extremities. All reflexes were gone, as were control of the bladder and rectum. Very soon afterward the patient began to have difficulties in swallowing.

I believe that this patient might have been saved if she had been operated upon within a few hours of the accident, when there were "incomplete" cord symptoms.

If, on the other hand, immediately after the accident, the patient has a complete loss of motor power and sensation with loss of superficial and deep reflexes below the level of the lesion, and with loss of control of bladder and rectum, we know that there is probably a complete and irremediable transverse lesion of the cord, and no operation is justified. Operative interference can do no good but only harm. If the injury is in the cervical region, death will be hastened by the operation—no matter how quickly and skilfully it be done. The disrepute into which operations for recent fracture of the spine with injury to the spinal cord have fallen is due to a great extent to the fact that patients with a transverse cord lesion have been operated upon. In a very few cases, improvement has followed the operation, but in these patients there could not have been a transverse lesion in the cord, and

it is questionable whether recovery might not have taken place if the operation had been delayed. Undoubtedly there are rare cases which at first present the symptoms of a transverse cord lesion but which recover to a great extent, thus proving that no transverse lesion had existed.

OPERATIVE INTERFERENCE IN OLD FRACTURES OF THE SPINE.

In the present state of medical opinion regarding the indications for operation in recent fracture with injury of the spinal cord, it is inevitable that many patients are allowed to go on without surgical interference who should have been operated upon. I have been asked to see patients many months or years after their injury. In some of these patients, the symptoms of cord injury were not very marked for weeks or months after the accident, but after a time signs of serious and progressive interference with the cord functions appeared. In other patients, the early signs of cord injury cleared up to a certain extent and improvement soon ceased. In many of these patients the X-ray examination [1] made long after the injury showed that, due to the original injury or perhaps to new bone deposits, there was a marked narrowing of the vertebral canal and therefore pressure on the cord, or a partial dislocation of the body or a lamina of one or more vertebræ, which caused a decided angulation of the cord. I have described a number of these cases in a previous paper.[2]

Many of these patients are incapacitated on account of well-marked paralyses of one or several extremities. As I have shown in the paper referred to, they can be greatly benefited by a free laminectomy with wide removal of spinous processes and laminæ well out to the intervertebral foramina, and exploratory opening of the dural sac. By this means, a narrowed spinal canal can be widened, pressure of bone upon nerve roots in the intervertebral foramina be removed, and a marked angulation of the cord straightened out by allowing

[1] X-ray pictures of the spine should always be taken from at least two sides—an anteroposterior and a lateral view.

[2] Loc. cit., S. G. & O., March, 1913.

room for the dural sac and cord to bulge backward. In some of these patients the prominence on the posterior surface of the body of a vertebra can be removed extradurally by drawing the dural sac to one side after the laminectomy has been performed, and removing the bony prominence upon which the cord is almost spitted. In most cases, the dura must be incised and the cord examined. Adhesions between the cord and the inner surface of the dura may be found and divided. A localized cyst or hæmatomyelia cavity may be found in the cord substance, laid open and drained.

CONCLUSIONS DRAWN FROM AN EXPERIMENTAL INVESTIGATION INTO THE PRACTICABILITY OF REDUCING THE CALIBRE OF THE THORACIC AORTA BY A METHOD OF PLICATION OR INFOLDING OF ITS WALLS, BY MEANS OF A LATERAL PARIETAL SUTURE APPLIED IN ONE OR MORE STAGES.*

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THE purpose of the experiments, which were exclusively performed on dogs, was to find a substitute for ligatures, or metallic or other constricting bands, intended for creating stenotic or atresic circular constrictions in the thoracic aorta, all of which, in our previous experience, had proved dangerous and impracticable in the upper aortic tract, the more dangerous and fatal as they approached the heart.

The circular purse-string sutures, applied in series and imbedded in the aortic wall, which had been first tried by Haecker, in 1908, were not considered, because his experience sufficiently proves that any circumferential constriction applied to the upper aorta with sufficient force to narrow the lumen of the vessel, is almost invariably followed by ulceration and fatal hemorrhage. Haecker's sutures were applied to the first portion of the aorta immediately outside of its origin in the heart. In five experiments, three dogs died from hemorrhage during the intervention. In the fourth, the completion of the suture was abandoned on account of profuse bleeding from a stitch hole. The last animal, which survived the in-

* Read before the American Surgical Association, May 7, 1913.

tervention, died twelve days later from erosion hemorrhage caused by the pressure of the knot.

In our experiments, the object sought was to produce a gradual stenosis of the aortic lumen by infolding or plaiting the walls of the vessel in its longitudinal axis. In applying these sutures, they were made as nearly interstitial or interparietal as possible. Our experience, and that of others (Carrel, Haecker, Guleke) proves conclusively that through-and-through sutures in the walls of the aorta of dogs, applied with any tension, are liable to cut through and are followed by secondary hemorrhage from ulceration and necrosis when fatal hemorrhage does not occur from the immediate cutting through of the sutures in the course of the operation.

In the abdominal aorta this danger is lessened by the greater firmness and better quality of the vessel walls and by utilizing the peritoneum which is included in the grip of the sutures, as well as by the marked tendency here to the formation of organizable plastic exudates which further support and encapsulate the line of suture. This tendency is almost entirely absent within the thorax. In addition, the line of suture may be fortified with strips of this membrane wrapped spirally around the vessel, a procedure which Jeger seems to have recently carried out independently of our work.[1]

Our experience also entirely confirms the observations made by Carrel and Guleke, who found that the walls of the thoracic aorta become progressively more friable as the heart

[1] Professor Halsted in his epochal and masterful paper on The Effect of Ligation of the Common Iliac Artery on the Circulation and Function of the Lower Extremity, which was published in the *Johns Hopkins Hospital Bulletin*, of 1912 (see bibliography), refers to recent experiments performed upon the abdominal aorta with ligatures and tissue bands, which are quite pertinent to our inquiry. His experiments refer chiefly to the abdominal aorta, which are quite different from those on the arch and thoracic aorta. On page 217 he writes: "We noted in our experiments that the aorta of dogs after having been totally occluded by silk ligature, may again become patulous. This restoration of the lumen is brought about by the cutting through of the ligature, and has usually been accompanied by the formation of a diaphragm of greater or less extent (see also *Jour. Exp. Med.*, 1909, vol. xi, No. 1). Similar obser-

is approached. Sutures applied to the ascending arch are much more liable to tear through and cause hemorrhage than the same sutures applied to the descending arch. In the ascending aorta the elastic media is the dominant coat and the fibrous adventitia is apparently too thin to offer any resistance to traction under the great strain and tension of the arterial stream in this region. The intima, though thick, offers little or no support to the sutures, as it is extremely soft and cuts through like wax under the pressure of the stitch. Some idea of the softness of the coat may be obtained when examining an aorta freshly removed from a dog. If placed on a solid surface and the vessel is firmly creased with the finger nail applied to the external coat, then opened and exposed, it will be found that the intima has been cut as with a knife. This peculiar friability of the ascending aorta in dogs, does not appear to be dependent upon the age of the animal, because, as Guleke has already noticed, it is sometimes observable to a very marked degree in young animals.

The plication of the aorta, as we have practised it, is carried out as follows: With a full curved intestinal needle (Pb No. 5, or straight milliner's needle, No. 16), in which we, in the earlier stages of this work, used No. 1 surgeons' silk (Corticelli twisted), often using it double, but later using a somewhat heavier material, the vessel wall is caught through its thickness outside the intima and at points directly opposite each other and approximated by tying. The sutures were

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vations have been made upon the human subject after the ligation of large arteries (innominate, subclavian, femoral). Acting on this hint given by Nature, I tested last winter on thirteen dogs the effect of partially occluding ligatures of fine silk, placed one above the other on the aorta, hoping that we might obtain a series of superimposed diaphragms which, if sufficient in number and extent, might sufficiently obturate the aorta to bring about the cure of the aneurism.

"But these partially occluding ligatures of fine silk, not only produced no diaphragms but gave rise, in two of the thirteen dogs, to fatal hemorrhages. From the totally occluding, crushing, coarse silk ligature in dogs, I have seen no such case of hemorrhage. Was then the fineness of the silk, or the incompleteness of the occlusion responsible for the bleeding? Or were both concerned in bringing about the result?

made continuous in our earlier work, but recently interrupted sutures, of the mattress type, have been preferred. The line of suture is made parallel to the long line of the vessel for a variable distance of from one to three inches. The infolding of the vessel wall progresses with each suture. The sheath of the vessel and the overlying pleura are not disturbed but included, whenever it is available, in the grip of the suture. During the suturing process no clamps are placed upon the aorta, only a tractor of stout silk or tape is passed under the vessel, in order to better draw it into the field. While the pulsations offer some disadvantage, it is much easier to work on the distended vessel, as one is better able to judge of the degree of penetration of the needle as well as determine the amount of constriction produced by each succeeding stitch than when working on a collapsed vessel. Furthermore, there is less interference with the heart's action, thus permitting a more deliberate and more prolonged work, the total occlusion of the aorta, on the proximal side of the carotid origins, being fatal in from one to four minutes.[2]

In our experiments no attempt was made to occlude the aorta, but a tractor of stout silk was passed around the vessel, at the origin of the left subclavian, in order to steady the vessel and bring it nearer the surface. The advantage of the

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[2] Our experience also confirms the observations made by Carrel and Guleke, as well as those of Lawen and Sievers, in regard to the short time that occlusion can be applied to the ascending arch without fatal consequences. Carrel found that in experimenting on dogs a total constriction of thirty-two seconds' duration can be tolerated without permanent damage to the brain. According to this investigator, the descending aorta can be compressed for seventeen minutes without fatal heart strain.

Our experiments show that a permanent contraction or narrowing of the aortic lumen in the thoracic aorta outside of the left subclavian, sufficient to obliterate the femoral pulses or to make them practically imperceptible, is tolerated by the heart of vigorous normal dogs sufficiently to permit of recovery by the rapid development of the collateral circulation.

Lawen and Sievers, in their experimental research upon "the influence of artificial respiration, strophanthin and adrenalin, upon the heart's action after a temporary occlusion of the aorta and of the pulmonary artery, in the performance of Trendelenburg's operation for the

traction loop over all forms of compressing devices is that it permits the aorta to be brought near the surface, closer to the operator, without necessarily arresting the circulation; it also allows the operator to familiarize himself, before beginning to suture, with the ability of the heart to adjust itself to varying degrees of occlusion. When traction is made on the loop sufficiently to constrict the lumen of the aorta, the heart reacts by rapid, very irregular and weaker beats than normal. However, it gradually adjusts itself to the obstruction, and contracts with regularity though with less rhythmic and less vigorous contractions. When the loop is relaxed, the sudden change in the resistance which the heart has had to overcome, again causes irregularity in the heart's action which gradually subsides to normal, if the traction is not renewed.

When the suture is satisfactorily applied, dogs tolerate with impunity a reduction of one-fourth to one-third the circumference of the vessel. After an interval of three to six weeks, a second plication is attempted, beginning just below the point where the first terminated, though occasionally the second plication was made over the first. The second plications were carried to a degree which still further reduced the calibre of the vessel, so that only a small pulse could be felt in the distal part of the aorta below the suture.

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extraction of pulmonary emboli," found that the extreme brevity of the time during which these vessels, for hæmostatic purposes, can be occluded with any safety to the animals (rabbits) was the chief difficulty in the operation. Lawen and Sievers performed a series of experiments to determine if it were not possible to prolong this stage of the operation by adopting different procedures. They occluded the aorta and pulmonary artery temporarily by tying a ligature around these vessels with just sufficient force to arrest the blood current and not damage the artery. They arrived at the following conclusions: The occlusion of the aorta and pulmonary artery cannot be prolonged beyond two and one-half minutes without causing the death of the animal. Death is preceded by a cessation of respiration and of heart beat. If artificial respiration is continued by intratracheal insufflation the ligature may remain *in situ* three and one-half to four minutes, beyond which recovery is impossible. If pure oxygen is insufflated into the lungs instead of atmospheric air, the occlusion of the blood-vessels may be maintained five and one-half minutes. The injection of artificial serum into the

The first operation is remarkably well sustained by the animals. The majority survive and recover rapidly, and the fact that in our experiments 75 of the animals survived sufficiently to undergo a second plication shows not only that the heart adjusts itself thoroughly to the demands made upon it by the obstruction, but that the collateral circulation is ample provided the heart is healthy and the animal young and vigorous, and a sufficient time is allowed to elapse for the animal to recover from the effects of the primary interference.

In the early part of our experimental work the error of over-plicating and encroaching too much upon the aortic calibre, was committed and in consequence a fatal paraplegia and other evidences of ischæmia of the spinal cord and lower extremities were recorded. When death has occurred in our later cases, it has been due either to intrathoracic infection, or marasmus induced by intestinal and cardiac parasitism with the dog filaria, which is a very common form of parasitism in the dogs of our section, or by accidental hemorrhage and pleural infection at the time of the operation.

All the experiments were conducted with artificial respiration by intralaryngeal insufflation with a soft rubber catheter introduced into the trachea through the glottis by the Meltzer-

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carotids, charged with oxygen to prevent asphyxia of the nerve centres, is less positive in its results.

In this series of experiments, the circulatory arrest could continue over five and one-half minutes, on an average, without absolutely fatal consequences. By applying massage to the heart as an excitant to the cardiac muscle, combined with oxygen insufflation, a compression of the vessels could be prolonged to six and one-half minutes. By injecting adrenalin (25 mg.) into the heart immediately after the untying of the occluding ligatures, while artificial respiration with oxygen was being kept up, they were able to save animals which had been occluded seven to eight minutes.

While the heart can stand a complete ischæmia for ten minutes, by total occlusion of the superior and inferior vena cavæ (Rehn *v.* Haecker, and Sauerbruch), the brain, especially the medulla which is far more sensitive, will not tolerate a total ischæmia, even with artificial respiration by intratracheal insufflation, beyond two and one-half minutes in rabbits, and scarcely, with any degree of safety, beyond one and one-half minutes in dogs and more highly organized animals.

Auer method. The intralaryngeal tube was attached to the Matas-Smyth pump, which permits the volume of insufflated air to be regulated with nicety and also permits of cumulative positive pressure with greater certainty, when required in inflating the lungs, better than with the ordinary bellows. In our later work, however, it was found equally practicable to use an ordinary foot bellows attached to an ether vapor anæsthetizing chamber. After introducing the tube into the trachea, the thorax is opened in the fourth left interspace by an intercostal incision (Mikulicz-Spangaro) extending from near the left sternal margin to the posterior axillary line. With strong self-retaining retractors, the ribs are separated for about three inches, giving a clear view of the heart, arch, and upper part of the thoracic aorta and hila of the lungs. In this way, the left pleura is opened; the air is continuously introduced into the lungs and allowed to escape in the usual way alongside of the laryngeal catheter. After the plication has been accomplished, and before closing the thoracic incision, the lungs are expanded to a maximum, in order to expel all air from the pleura and are held to the chest wall by cumulative positive pressure long enough to complete the hermetic suture of the pleura and the intercostal space. We agree with Guleke that this is a very important detail in the technic, because if air is allowed to remain in the pleura the full expansion of the lungs is interfered with, allowing a partial pneumothorax to remain, which is followed by a profuse transudation of serum. In turn, this is secondarily infected, causing a septic pleurisy which often ends in the death of the animal in a few days. This will often happen, in spite of the most rigid asepsis and after every precaution has been taken to pack off the lungs and pleural cavity with warm sterile salt towels, leaving only the upper part of the aorta exposed in the field of operation.

Since our experience in plication, which Dr. Allen first began in May, 1910, 151 dogs have been subjected to the primary plication.

Of these, 73 were plaited a second time, and of the 78 re-

maining, 4 died of hemorrhage, 7 of infection, and 3 from the anæsthetic. Some of the remainder were sacrificed for study, while others died of parasitism or disease, or escaped through accident or neglect on the part of the laboratory employes.[3]

Of the 73 secondary plications, 29 died of hemorrhage; 15 of parasitism and marasmus from various causes; 7 from post-operative pleural infections; 4 escaped; 4 died of the anæsthetic, while attempting a third stage, or total occlusion, operation; in 3 no cause of death was determined.

Of the 11 which reached the third or obliterative stage of plication, 6 died of hemorrhage; 2 from pleural infections on the fourth and seventh days; 3 from parasitism and probably cardiac asthenia.

In all the more recent cases, the line of suture could be recognized though buried in a relatively thin layer of exudates; in others, the suture line was still better recognized when a shorter lapse of time had occurred between the operation and the death of the animal. In the older cases, three weeks or longer, the suture line was not clearly discernible, being deeply buried in the organized exudates and in the vessel wall which was always thickened at the line of suture. Some of the sutures relaxed, but all remained under the cover of a thin exudate layer.

The examination of the two specimens obtained from the animals dying of pleural infections, showed the line of suture fresh and thoroughly recognizable through a layer of exudate. A cross section of the sutured segment showed a very great encroachment upon the lumen of the vessel by the plicated fold which practically packed the lumen but not sufficiently to prevent the circulation of fluids under pressure. The narrow space intervening between the convexity or bulge of the fold and the ensheathing arterial wall always becoming apparent and wider whenever fluid was forced through it.

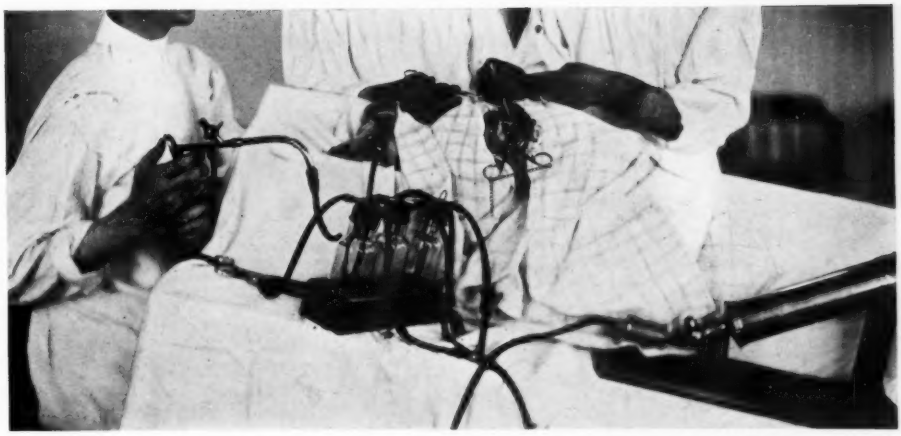
The three animals dying after a lapse of three, four, and

[3] On one occasion a whole pack of experimented dogs were liberated at the close of the winter's work, for economic reasons. On another occasion a number of dogs that had survived the first and second plications were set free through the efforts of persons residing in the neighborhood of the college, to whom the yelping and barking of the dogs had been annoying, the animals being kept in an open enclosure in the college grounds.

seven days respectively, showed, as in all the dogs that had survived, a marked plication, a hypertrophy and dilatation of the left ventricle which had no doubt been initiated by the obstacle put in the way of the aorta by the first plication. The specimens of the plicated segment, in this last group, exhibited the same gross characteristics noted in the previous two cases, viz.: in all, the lumen was crowded and packed tightly by the plait of the infolded wall, narrowing it to a slit-like space, though the actual degree of obstruction varied to some extent in the different animals. In all, the infolded mass or plica, practically filled the aortic lumen, but in animals that had longest survived the operation, the potential space existing between the infolded mass and the wall was greater than in those dying within a shorter time. The causes of death in these instances were multiple. The immediate causes were: cardiac asthenia, or exhaustion, in which the previous and long standing efforts of the heart to overcome stenosis in otherwise marasmic and enfeebled animals played the chief part. In one of these dogs, the cardiac action was embarrassed by the presence of a large swarming mass of adult filaria which filled the right heart (see Fig. 5). The other two dogs had also been greatly enfeebled by uncinariasis, which is as prolific a cause of disease in the dog, as in the human species and is especially prevalent among dogs kept in captivity and in unhygienic surroundings. In all the dogs that reached the third stage of plication, the nutritional conditions were bad, leading practically to a marasmic state from prolonged confinement in the laboratory and in small enclosures which still further reduced the resistance of these animals to trauma and cardiac strain.

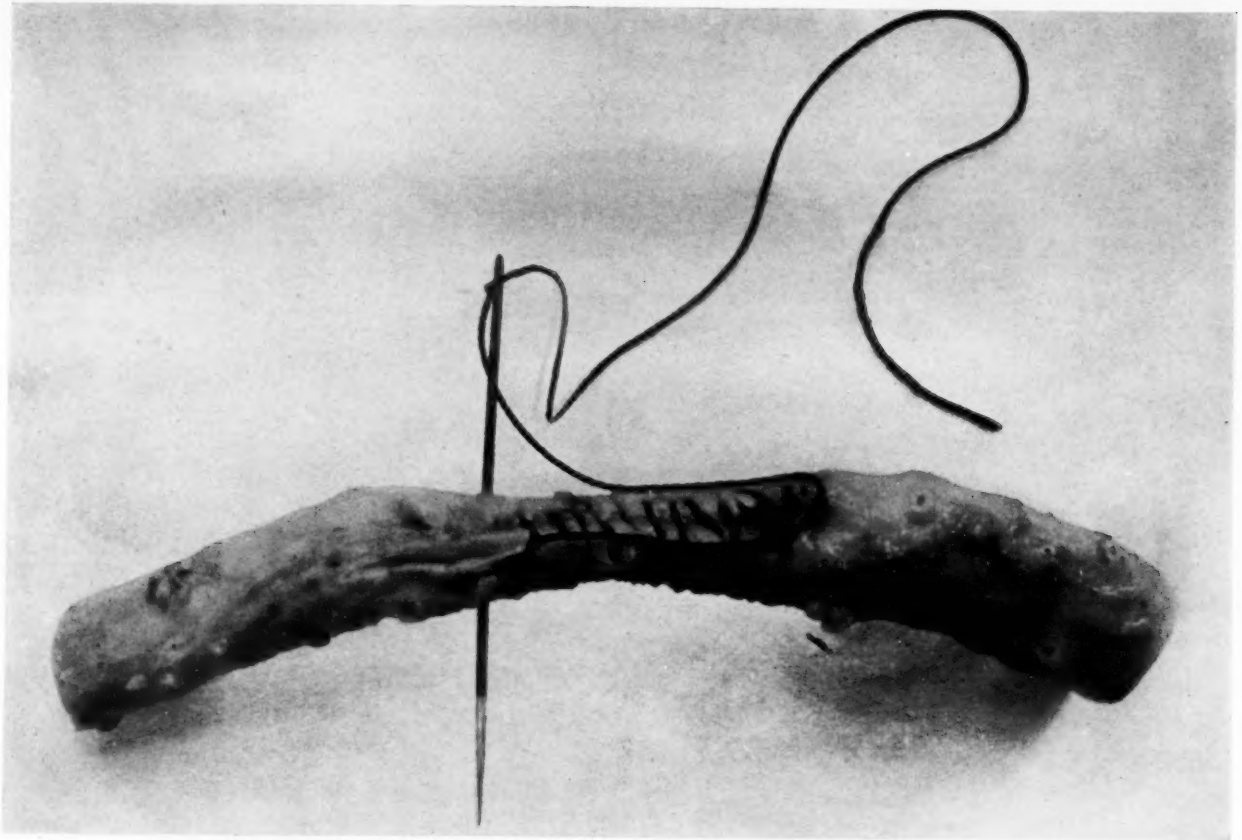
It is interesting to note that, as previously stated, in these extreme cases of stenosis, some of the animals were able to survive as long as seven days and finally died without showing any of the evidences of peripheral ischæmia, palsy of the hindquarters and other disturbances which are characteristic of acute aortic obstruction whether from experimental or purely pathologic causes (ligatures, bands, thrombi, etc.). The absence of these special phenomena is to be accounted for by the gradual reduction of the aortic circulation, brought about by the previous plications in two sittings at long intervals, by the compensatory hypertrophy of the cardiac muscle and by the development of

FIG. 1.



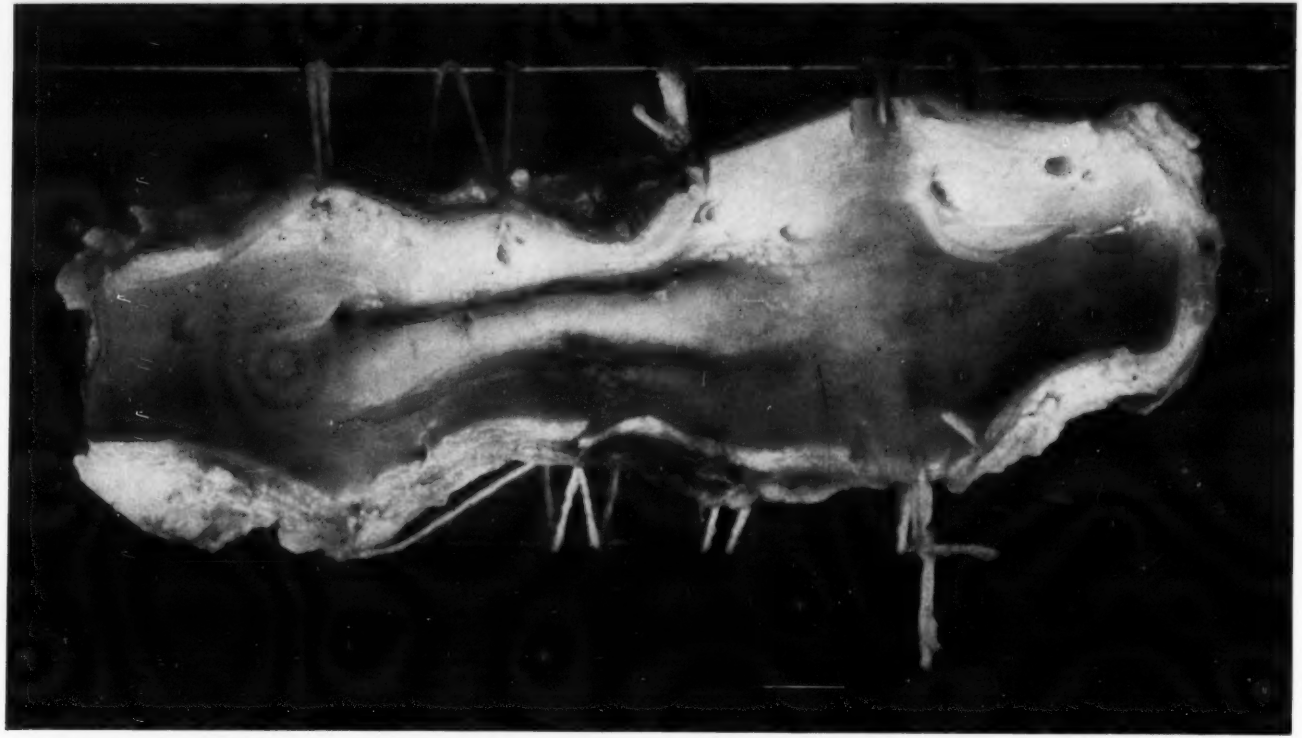
Showing general arrangement of operating table with dog on frame, Matas-Smyth pump in operation. Self-retaining retractor in position, between third and fourth left ribs, exposing thoracic cavity. Tractor of stout silk passed around aorta at origin of left subclavian, drawing heart and vessel up into wound; parts of lung seen in background above and below heart. Needle is being passed through adventitia of aorta.

FIG. 2.



Section of aorta magnified three times, showing method of plication. Needle is seen transfixing two folds on walls of aorta with groove between. The apparent depth of the needle, as indicated in the photo, is due to the vessel being covered by cellular tissue and pleura. The coarse and woody appearance of the specimen is due to the hardening effect of the formalin solution in which it was preserved. The same observation applies to all other specimens shown in these photographs.

FIG. 3.

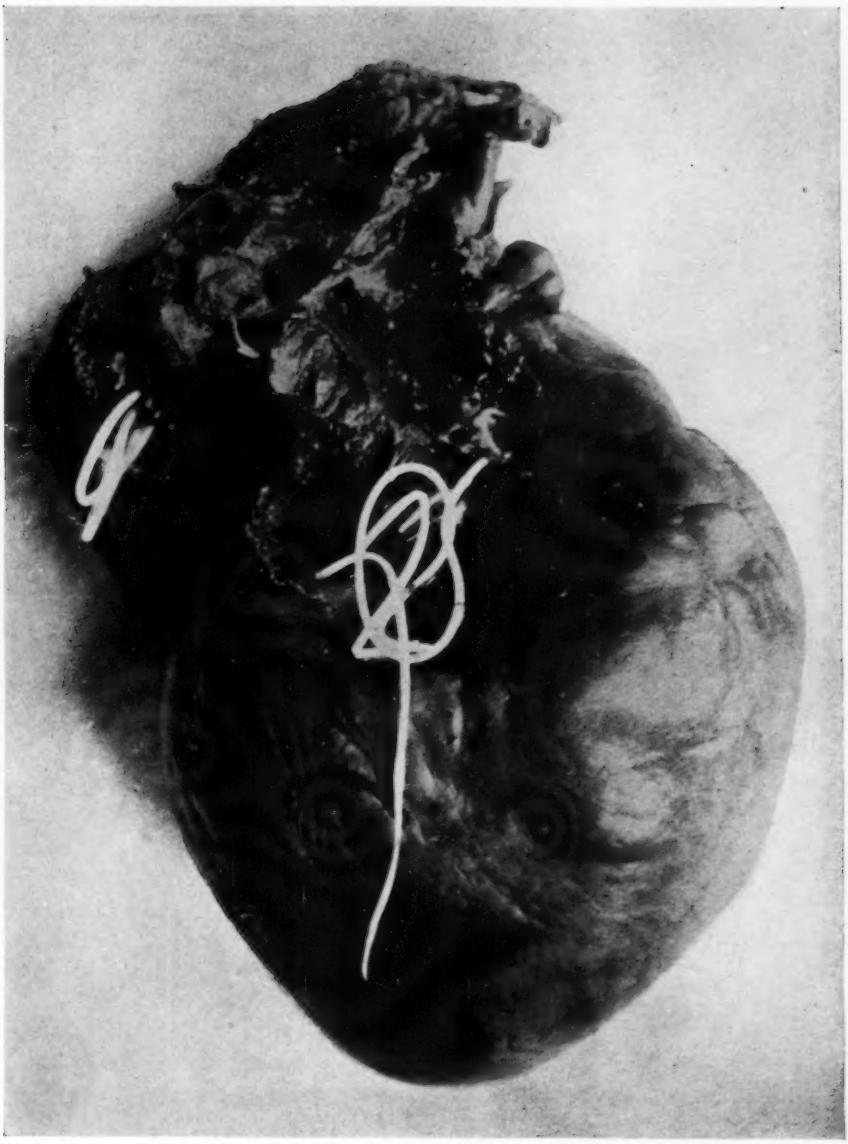


Internal appearance of plicated aorta thirty-three days after operation. Defect in intima to side of plication is due to tear which occurred during mounting, after vessel had been hardened for some days in formalin solution.

FIG. 4.

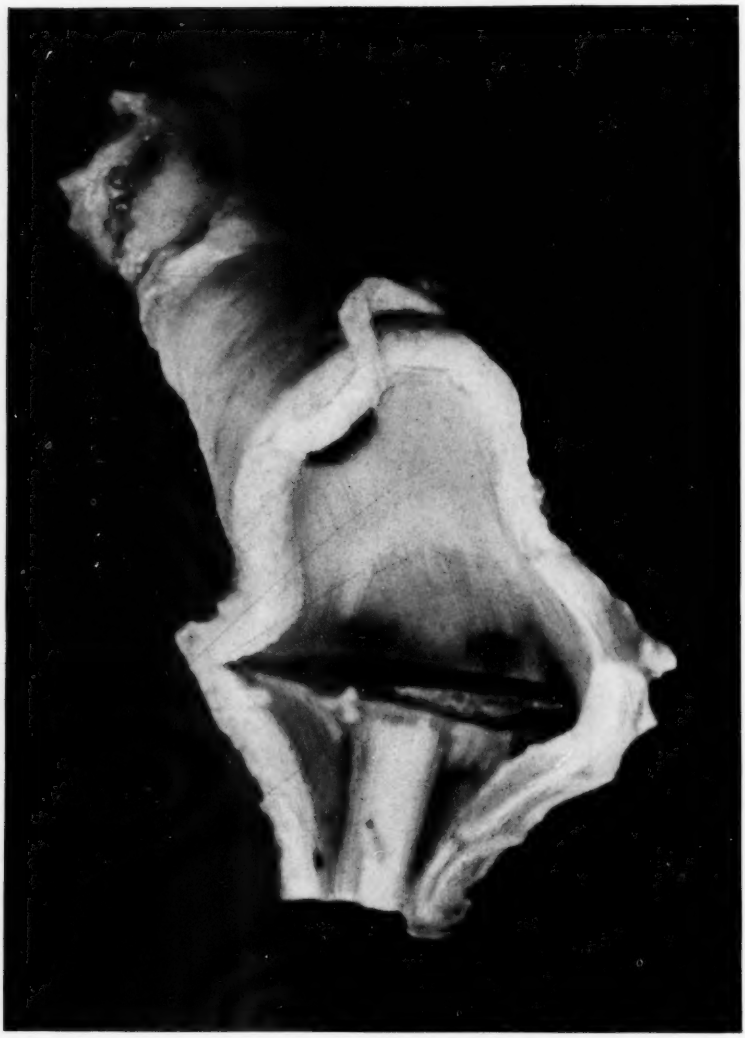
Shows lumen of aorta completely obliterated after three successive plications over same site. Dog died twenty hours after third operation, which at the time of the operation apparently completely occluded the aorta, the death being attributed to the combined effects of heart strain upon a pathologic heart weakened by prolonged filarial parasitism of the gross type. It was also found, at the postmortem, that the apparently complete occlusion, which had been demonstrated at the completion of the operation, had yielded during the twenty hours that the animal had survived, sufficiently to allow a small stream of water to be forced through by injecting the aorta. Apparently this exceedingly small channel was sufficient to permit a reduced circulation to be maintained and to prevent a total ischæmia of the peripheral parts. It is also probable that the remarkable adaptation shown by this animal to a greatly reduced aortic circulation caused by an almost complete atresia of the vessel was due to the development of the collateral circulation following the earlier plications.

FIG. 5.



Heart from same dog (Fig. 4), shows filaria protruding from openings.

FIG. 6.



Shows internal appearance of vessel cut across at narrowest part of constriction. Animal killed ninety-seven days after second operation.

FIG. 7.

Transverse section of vessel twenty-five days after second operation. Vessel was constricted almost to point of obliteration of pulse. Shows marked infolding of lumen. Compare with Fig. 4, which shows complete obliteration.

an adequate collateral circulation which seemed to be sufficient, when the third stage of plication was reached, to meet the requirements of the tissues beyond the stenosis. Lastly, by the fact that in every case the potential space existing between the infolded mass or plica and the enveloping sheath was never totally obliterated, but remained sufficiently patulous to allow the persistence of a minor circulation which increased in volume in direct ratio to the duration of the survival of the animal; the longer the survival, the larger the space. In other words, there was only a stenosis and never an atresia.

The conditions which are created in the aorta by plication might be compared to those of the pylorus whenever an attempt is made to occlude it in connection with gastro-enterostomy, when this is performed for the cure of duodenal ulcer. It has been found that whenever the pylorus is obstructed by plication or plaiting by the methods of Doyen, Delling, Mayo, and others, the plicated segment always stretches and yields in the course of time, no matter how thoroughly it may be infolded upon itself by sutures.[4]

It is quite evident that all stenoses or obstruction caused by the infolding of mucous-lined or endothelial-lined channels, should ultimately yield and stretch sufficiently to allow of free circulation through the plicated segment, if there is sufficient power or *vis a tergo* in front of the constriction to force and direct fluids in the potential space that always exists between the opposed mucous or endothelial surfaces, as the case may be. As long as there is no actual destruction of the endothelial lining in the plicated aorta, or of the epithelium in the pylorus, at the point of constriction, by inflammatory action or other destructive agency, this space must persist, no matter how close the apposition of the surfaces may be, and is always ready to stretch and dilate by the yielding of the opposed elastic walls whenever any fluid is forcibly injected into it.

On the other hand, a stenotic condition is obtained both in the aorta and in the pylorus by the method of plication which

[4] See Gino Baggio: Sull' Exclusione del piloro coi metodi costrittivi, p. 1055, and F. Nassetti: Esclusioni del piloro, p. 1075 in Clin. Chirurgica, Milano, May 31, 1913, anno 21, No. 5.

may be of therapeutic value, before the obstruction is either partly or entirely overcome. In the aorta, a stenosis could undoubtedly be produced by plication which would reduce the circulation in an aneurismal sac, situated in the proximal and distal side, sufficiently to bring about a cure by the deposition of fibrinous clot. In planning these experiments, in the thoracic aorta, we had contemplated a more radical procedure as the final stage of the stenotic treatment, to be applied to animals that had survived the third plication. It was our intention, after satisfying ourselves of the tolerance of the dogs to this maximum degree of stenosis, to completely divide the aorta in the infolded segment and then seal the stumps by suture or ligature. Thus we had hoped to repeat in the thorax what one of us (Dr. Allen) had accomplished successfully and repeatedly (four times) in the abdominal aorta, viz., the complete section of this vessel below the renals after a series of gradually progressive constrictions with our modification of Dr. Halsted's aluminum bands.

That the aorta can be divided in its thoracic portion below the subclavians, after a sufficient preliminary treatment by the production of gradually increasing stenoses, we believe is quite possible and practicable in young and vigorous animals kept in perfect hygienic conditions. Whether this can be accomplished more certainly and satisfactorily by encircling the aorta with organizable aponeurotic strips (fascia lata) as advocated by Nassetti, or with strips of dogs' aorta, as recently practised by Halsted, is a matter that must be decided by further experimentation.

Sufficient evidence has accumulated to show that in the abdominal aorta the problem of gradual occlusion, especially below the renals, has been solved. We have shown that this occlusion can be made so complete as to permit a total transverse division of the vessel and yet the animal recover permanently from the intervention, and this we have done with constricting aluminum bands. Dr. Halsted had previously demonstrated the possibility of creating marked stenosis in the lower thoracic abdominal aorta by practically the same means though he had not carried the experiment to the point

of complete division of the vessel at the stenotic level. He has also shown that the same constriction can be obtained by applying constricting strips of dog aorta. Nassetti has likewise shown that aponeurotic bands can be used successfully to accomplish the same purpose, but thus far a total and absolute atresia of the thoracic aorta, in its upper portion close to the arch, by any of the methods proposed, with permanent recovery of the experimented animals, has not yet been satisfactorily demonstrated.

Our experiments with plication show how nearly we have attained this difficult, but not impossible accomplishment. In the course of these experiments, a large number of segments of the plicated aorta have been preserved with the view of studying the histologic changes that take place in the plicated area and the sutured aortic walls. We had hoped to demonstrate in the course of time, that the endothelial surfaces brought in apposition by the plication would ultimately fuse and blend, through cell proliferation. In this way the potential space, to which we have so frequently referred, as existing between the endothelial surface of the plica and of the sheath, would be totally obliterated, just as the lumen of an artery is obliterated by plastic and proliferative endarteritis when it is constricted with just sufficient force to arrest the circulation in the vessel without crushing its coats. If we may correctly interpret the specimens that we have thus far obtained, it would appear that the constriction obtained by parietal suturing sufficient to infold the vessel walls, is not capable of inducing sufficient trauma to bring about an adhesive or obliterative endarteritis in the infolded segment. Dr. Halsted has also shown, by his notable experiments, in constricting the abdominal aorta with his aluminum bands, that the aortic walls may, in some cases, be infolded to a sufficient extent to narrow the lumen of the vessel short of a total occlusion for almost an indefinite length of time without the production of an obliterative endarteritis. This, however, is an exceptional result when metallic bands or circular constricting agents are used. Usually the traumatism caused by the constriction leads either to an obliteration of the vessel by ulcerative

changes, or by the atrophy of the wall, which brings the constricting band in contact with the intima or with the blood stream which in turn is the cause of an obliterative endarteritis. In the abdominal aorta, the dangers of excessive constriction with secondary ulceration or atrophic changes are guarded by the strong encapsulating rings which surround the constricted areas, a protection which is lacking in the thoracic aorta, especially in its upper segment.

In further confirmation of the preceding facts, our observations upon the sutured aorta, in the second and third operations, have shown a gradual tendency toward the reëstablishment of the lumen. This has been principally due to a gradual relaxation and yielding of the sutured portion, though it seemed, in some cases, to be partially due to a compensatory dilatation of the remaining portions of the vessel wall at this point. This tendency was greater the longer the interval between the operations, and was decidedly greater after the second than after the first operation. About 65 per cent. of the cases maintained the primary degree of constriction unchanged for a period averaging about three weeks. Probably less than half this percentage (28 to 30) retained the original constriction after the second operation for the same period of time.

It is quite evident from all our observations that, if it is at all healthy, the heart and all the forces of the organism are set to work to remove the obstacle in the main channel of the circulation, thus defeating, in the course of time, the most carefully executed plans of the operator. Thus far, no animal has survived a third plication, which caused a total obliteration of the lumen, or which would permit of a complete dry section of the aorta through the plicated segment. But the capacity of the heart to adjust itself to an extreme degree of aortic stenosis, when this is gradually accomplished, is indeed remarkable and most noteworthy, as shown in the animals from which the specimens were removed which have furnished our illustrations.

The applications which we have thought might be made of the foregoing experimental facts in human surgery, are:

The practicability of blocking the thoracic aorta sufficiently to favor the gradual deposition of the clot in an aneurism situated in front or behind the plication, and to obtain this stenosis or constriction in a safer and more certain way than can be accomplished by ligatures or bands of metal or other material, which constrict the vessel circumferentially and over a comparatively narrow area.

Second: To reduce the calibre of the fusiform, cylindrical, or saccular aneurisms, that are otherwise inoperable, by reinforcing their walls by plication.

In addition to plication, we have thought of the possibility of strengthening and supporting the walls of rapidly expanding aneurisms, which are otherwise inoperable, by wrapping them at the weakest points with free flaps of fascia (aponeurotic grafts), as the most available material, which we would suture to the sac. In other places this is a good grafting material, but we have not yet sufficiently tried it to permit us to express a definite judgment as to its value; but this is an afterthought which has only been suggested by the recent work of Nassetti and of Halsted. Thus far the method of exclusion or short circuiting, applied to aneurismal areas situated in the aortic tract, by means of direct anastomotic connections or with transplanted vessels, provisional or glass tubes, by the ingenious procedures devised by Carrel and more recently by Jeger and Schuppelmann in their experimental work, has no application to surgery. No method of anastomosis can provide for the maintenance of the indispensable cerebral circulation whenever the carotid bearing section of the arch is excluded from this vessel.

In the abdominal aortic tract, the possibility of transplanting the great visceral trunks, either by the method of Carrel, or by the very ingenious and successful technic of Jeger and his associates, which has led to such remarkable results in the transplantation of the renal vessels, must be recognized as an experimental fact which may soon have very decided application in the surgery of abdominal aneurism. This new development in the technic will permit of the obliteration of an aneurismal sac by aneurismorrhaphy or its extirpation, pro-

vided the great visceral arteries (cœliac axis, the mesenteric arteries, the renals) which spring from these sacs, may be safely transplanted to another level of the main trunk above or below the obliterated sac.

In the light of our present knowledge, the direct intervention of surgery in the treatment of aortic aneurism must be restricted to *explorations,* both abdominal and thoracic, which will permit us to ascertain the relations of the aneurismal sac to the parent vessel. In a certain number of cases of saccular aneurism, it may be posible to obliterate the communications leading from the sac to the artery, by the method of intrasaccular suture. In the majority of cases the operation will have to be limited to methods which will simply tend to reduce the circulation in the sac and thus favor the coagulation of its contents. This may be accomplished by any of the classical methods of wiring or by narrowing the lumen of the vessel immediately above or below the aneurism, by the use of constricting agents, whether metallic (Halsted or Matas-Allen aluminum bands), or tissue strips (aponeurosis, Nassetti; aortic, Halsted), or by suture methods, such as the plicating procedure which has been the special object of the investigations which Dr. Allen and I have conducted in the laboratory of experimental surgery of the Tulane University and which are possibly more feasible in the human aorta than in that of the dog.

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SOME ANATOMIC AND PHYSIOLOGIC PRINCIPLES CONCERNING PYLORIC ULCER.

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THE inclination of the present day anatomist is to present his subject to us based on its embryology and biology rather than upon the mere gross appearance. This has caused changes in nomenclature, shifting of boundary lines and in some instances changes of description when contrasted with those of older teachers.

When carefully studied in relation to development, blood and nerve supply, lymphatic drainage and especially in connection with physiology and pathology, there is ample justification for reconsideration of nomenclature in many areas. This is especially true of the alimentary canal.

Using the old nomenclature, the stomach and that portion of the duodenum as far as the point of entrance of the common duct (derived from the foregut) is functionally sharply delimited from the small intestine and proximal half of the large bowel (midgut derivatives), and this in turn has functions different from the part of the bowel beyond the splenic flexure. The abdominal part of the alimentary canal having its origin from the foregut, namely the stomach and proximal duodenum, is supplied with blood solely through derivatives of the cœliac axis; beyond this to the splenic flexure (midgut) solely through the superior mesenteric and beyond the splenic flexure (hind-gut) to the lower third, of the rectum, through the inferior mesenteric vessels. Physiologically the foregut derivatives prepare food for digestion, the midgut derivatives further digest and absorb substances, the hind-gut derivatives expel the residue. Pathologically, evidences of delimitation of these three areas are also seen.

There are several important considerations with reference to the anatomy and physiology of the stomach and duodenum

in relation to ulcer. The point of the duodenum above the common duct, namely about the first four inches, is in reality a part of the stomach and should be so considered. This part of the alimentary tube together with the stomach proper is derived from the foregut; has the same blood supply as the rest of the stomach, namely through the cœliac axis; the same nerve supply through the pneumogastrics, and sympathetics, and the same lymphatic drainage. Its mucous membrane is thin and granular, it contains no valvulæ conniventes, and does contain Brunner's glands which are identical in structure with the hydrochloric acid glands of the stomach. Its functions and diseases are those of the pyloric region of the stomach. The proximal duodenum does not exhibit peristalsis and in this respect is like the cardiac end of the stomach. Like the cardiac end also it serves as a mixing chamber for the food and digestive secretions, being acted upon by respiratory movements of the diaphragm through the liver.

A new nomenclature might designate various parts of the stomach as follows: It is divided into two parts, the left or cardiac portion and the right or pyloric portion, by a line passing from the incisura angularis on the lesser curvature to a point opposite on the greater curvature. The cardiac portion would then be subdivided into the cardiac fundus, cardiac sac, or cardiac chamber, and the body of the stomach. The pyloric portion would be subdivided into the pyloric vestibule, pyloric canal, and pyloric fundus, pyloric sac, or pyloric chamber, at present designated as the proximal duodenum (Mayo).

The fundus and body of the stomach are supplied by the gastric and splenic arteries, while the whole pyloric portion, including the pyloric chamber down to the common duct, is supplied by the hepatic artery through its pyloric and gastroduodenal branches. These are all derivatives of the cœliac axis. The small intestine beyond the common duct gets all of its blood supply through the superior mesenteric arteries. Even the inferior pancreaticoduodenal branch of this vessel

does not supply any part of the tube above the common duct.

The entire pylorus and duodenum when considered together are arranged grossly in the shape of an 'S' placed transversely. This shape is comparable with that of the S-trap employed by plumbers and allows the acid chyme, bile, and pancreatic fluid to accumulate in the pyloric chamber between the sphincter muscle and the common duct. That accumulation actually occurs is shown by the fact that this part of the pylorus is always stained with bile after death and in comparison with the remaining part of the small intestine is much dilated. X-ray pictures taken after the administration of bismuth show an accumulation of bismuth in this area designated by radiographers the "pyloric cap." The S-shaped arrangement also prevents regurgitation of gas and fluid from the small intestines into the stomach. The ease with which patients under certain circumstances vomit large quantities of bile and alkaline fluid shows inadequacy of the pyloric sphincter as a partition.

The upper margin of the entire stomach along the lesser curvature and for two inches beyond the pyloric sphincter, is suspended from the liver by the gastrohepatic omentum, the free edge of which is called the duodeno-hepatic ligament. Free mobility of the stomach and proximal duodenum is thus permitted. Beyond the duodeno-hepatic ligament and especially beyond the opening of the common duct, the duodenum is securely fixed in position, behind the peritoneum.

Chronic ulcers of the pyloric region are found just twice as commonly in that portion just distal to the pyloric sphincter as they are in the part of the stomach on the proximal side of the sphincter. In 621 cases Mayo found 64½ per cent. on the duodenal side and 32½ per cent. on the gastric side of the pyloric sphincter, 3 per cent. were found on both sides. By all odds the greatest number (90 per cent.) of ulcers at present designated duodenal in location, are found in the first two inches of the duodenal portion of the pylorus and for this there are definite anatomic reasons. This location corresponds to the highest point of the pyloric region, the fundus.

The fundus of all organs is notoriously deficient in blood supply as compared to other parts of the organ. Witness for example the gall-bladder, the urinary bladder, the uterus, and even the fundus of the cardiac end of the stomach. Mayo's anæmic spot is located in the fundus of the pylorus and Wilkie, from a study of 40 specimens with reference to the arterial supply of the pyloric area, found the first two inches of the duodenal portion of the pylorus markedly deficient in blood supply as compared with the rest of the region. This investigator has shown that the first two inches of the duodenal portion of the pylorus is supplied by the supraduodenal artery which though usually a branch of the gastroduodenal, sometimes arises from the hepatic and other arteries in the neighborhood. The anastomosis of the supraduodenal with the surrounding arteries is very imperfect and often this is a true end artery with no anastomosis. The first two inches of the duodenal portion of the pylorus is therefore designated as the critical area on account of its deficiency of blood supply and its notoriously common seat for ulcer formation.

Moreover, the first two inches of the proximal duodenum is freely movable whereas the area beyond is comparatively fixed. It therefore represents the junction of a fixed and movable portion. The tendency for infection to be located at such a junction is strikingly manifested by the localization of tuberculosis of the spine at the dorsolumbar junction. Moreover in the pylorus this critical area represents the junction of two curves, the ascending and the descending portions of the proximal duodenum. The tendency for localization of infection at the meeting place of two curves is exhibited by other structures throughout the body.

The dome of this region is commonly the point affected and the dome of all hollow organs is relatively poorly supplied with blood. The slight local anæmia incident to vascular sclerosis may account for the greater tendency to ulcer in men as compared to women. Ulcer is in reality local circumscribed gangrene and men are more frequently the victims of gangrene than are women though no more commonly the

soil for infection. As to whether the slightly higher location of the pylorus fundus in men (Mayo) or the slightly greater tendency to V-shape of the duodenum in women (Piersol) can account for the greater frequency of ulcer in men remains yet to be determined.

There are anatomic conditions which make possible the belief which I am about to express for perhaps the first time, that ulcer of the gastric side of the pylorus sphincter is perhaps a later development representing an extension of infection and that perhaps the lesion begins as an inflammatory process on the duodenal side of this sphincter, in the part of least defence, the fundus of the pylorus.

Anatomic conditions in women may or may not be less favorable to the development of ulcer on the duodenal side, but infection may occur and being resisted and its symptoms borne, may progress through the lymphatic vessels in the mucous and submucous coats of the pylorus to the gastric side of the sphincter where it is found at a later period on the table or at autopsy. This may account for the older figures from autopsy findings showing greater frequency of gastric than duodenal ulcer in women than in men, though doubtless as Mayo suggests, many cases in reality of duodenal ulcer, were called gastric on account of failure accurately to locate the ulcer in relation to the pyloric sphincter. This continuity of lymphatic vessels in the mucous and submucous coats of the duodenum and stomach may also account for those ulcers which are continuous across the sphincter on both sides.

Any study based on sex incidence of diseases of the digestive apparatus save those incident or secondary to pregnancy or lesions of the generative organs, gives little or no information as to the specific primary exciting cause. Men, as compared to women, are notoriously intolerant to pain and to infection. Women have both an inherited and an acquired resistance to infection. Phylogenetically we should expect processes of infection and pain to pursue a more mild clinical course, and be more easily resisted by females than by males.

More men than women are operated upon for pyloric ulcer but there is no reason to believe that the bacteria of the duodenum and bile tract are more numerous or of greater virulence in men than in women. Perhaps the male intolerance to both pain and infection causes us, through seeking operative interference, to secure the preventive treatment of at least gall-stones and perhaps of the extension of ulcer or its cause from the duodenal to the gastric side of the pylorus.

Pyloric ulcer is found at operation more frequently in men than in women, whereas chronic appendicitis and biliary calculi are more common in women. Appendicitis and bile tract infection are much more frequent than pyloric ulcer. For acute abdominal diseases, barring gynæcologic affections, more males than females are operated upon. In females, chronic lesions are found more commonly. Pyloric ulcer even though chronic, certainly must be more constantly and positively painful and productive of acute indigestion than are attenuated chronic infections of the bile tract and gall-bladder calculi.

THE RELATIONSHIP BETWEEN GASTRIC AND PANCREATIC CARCINOMA.*

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OBSERVATION of a case of carcinoma of the stomach, which had invaded the pancreas, eventually causing leakage of pancreatic secretion with subsequent generalized fat necrosis, has led the writer into a survey of the literature of this subject with the result that there is found a comparatively large group of recorded cases, wherein the combined symptomatology of a gastric carcinoma with extension to the pancreas has occasioned a peculiar, baffling train of events, presenting great diagnostic difficulties and uncertain of explanation even when the diagnosis is assured by laparotomy or autopsy.

The history of the case prompting this report is as follows:

Mrs. X, forty-nine years, III-para, a woman of excellent heredity and a negative previous medical history was first seen in consultation June, 1911, when she complained of some acid indigestion with œdema of the feet.

She was a very large, robust woman, who suffered from some distress and eructation after eating, but with no nausea or vomiting.

Examination of the chest and abdomen proved entirely negative, there was no demonstrable disease of the nervous system, the urine was normal, the hemoglobin 95 per cent. A short course of antacid treatment with regulation of the diet promptly relieved the symptoms.

In Nov., 1911, the patient suffered from an acute attack of pain in the abdomen, well localized in the right hypochondrium, the pain coming on without apparent cause and during what seemed to be normal health. She was under the care of Dr. J. O. Tilton, of Lexington, Mass., and in spite of all medical treatment failed to improve. The pain continued, the patient became

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jaundiced, constipated and a small mass developed on the right side in the gall-bladder region.

Dec. 6, 1911, the writer was called into consultation and the following conditions were noted:

A well nourished woman, suffering a moderate degree of abdominal pain but not exhibiting any evidences of shock. She was moderately jaundiced, the sclera deeply stained, the tongue was pale and flabby, the pulse full and strong. There was no history of sweats but occasional slight chills were noted; the temperature rose from normal in the morning to 100° F. at night, there was some degree of nausea and distaste for food, but no vomiting. Pain was considerably increased immediately after eating solid food. The heart and lungs proved negative to physical examination, the blood pressure was 130 mm.

The abdomen was slightly distended but soft and presented a small rounded mass in the right nipple line, just below the costal margin; the mass moved synchronously with the respiratory excursion, was semi-fluctuating in character and was very tender, pain on palpation was distinctly transmitted to the left lumbar region, high up.

The stomach could be indefinitely outlined and revealed no evidence of gross change.

The pelvic organs were normal, the urine was bile-stained, negative for sugar, albumin and casts. There was no fat present in the somewhat pale stool. After further consultation with Dr. Tilton and Dr. E. H. Stevens, of Cambridge, a diagnosis of cholelithiasis was made and the patient removed to the Copp Hospital for operation. It may be noted that she walked without discomfort down a flight of stairs to an automobile and rode six miles to the hospital where she mounted another flight of stairs without exhaustion.

Under ether anæsthesia, the gall-bladder was exposed by an incision parallel to the costal margin. Upon opening the peritoneum the palpable mass was found to consist of rolled up omentum, densely adherent and undergoing fat necrosis. The entire upper segment of the abdomen showed extensive fat necrosis and the structures were so densely adherent that relations were indistinguishable. The gall-bladder was collapsed and pale and contained no stones. On account of the violent hemorrhage encountered when adhesions were separated, it was

impossible to examine the pancreas in detail, but it was found hard and indurated and considerably enlarged. The stomach was normal in size and presented a small thickened area at the pylorus which was buried in adhesions.

Free drainage was instituted with no attempt at any radical measures which were obviously impossible in the face of the fat necrosis and severe hemorrhage, and the patient returned to bed.

She improved slowly for ten days, with free drainage of sero-purulent fluid containing pancreatic ferments, and with marked relief of pain and tenderness. Then, suddenly the temperature rose to 104° F., the abdomen became enormously distended and the patient died in collapse.

The autopsy performed by Dr. A. F. Boretti showed the parietal peritoneum thickly covered with granular and stringy fibrous exudate matting together every loop of intestine and forming a mass of adhesions around stomach and in right hypochondrium. Abdominal cavity contains (estimated) 1500 c.c. of turbid blood-stained fluid with a marked odor of formalin. Pelvic organs not remarkable. In right hypochondrium, in region corresponding to abdominal wound, several structures are firmly matted together and cannot be separated without tearing. The liver is enlarged, all its surfaces adherent to the surrounding peritoneal layers. The gall-bladder is covered with fibrous adhesions but contains no stones and is practically empty. The stomach feels thickened in its pyloric portion. The spleen is greatly enlarged, soft and held down in its fossa by soft, fibrinous adhesions. Because of the very marked adhesions all attempts at dissecting and following out the branches of the portal vein and bile ducts are unsuccessful. The intestines are removed as far as the duodenum and are not remarkable except as described. Duodenum opened *in situ*, shows no gross change. Stomach shows, bordering on the pyloric rim, and located in its posterior surface, a round, conical ulceration measuring 2 cm. in diameter by about 1 cm. in depth with an eroded, granular, grayish-red floor, the substance around it being thickened, on section presenting a grayish, nodular appearance and firm consistence.

This thickened portion tapers off gradually into the surrounding stomach wall, the mucosa of which has a granular, atrophic appearance.

Pancreas.—Is firmly adherent to the posterior abdominal wall and to the surrounding structures; the head and tail are normal as is the lower part of the body. In the upper part of the body, near its middle, is a mass the size of a hen's egg showing on section, the same grayish, nodular appearance noticed in the above described area in the stomach. On manipulating the structures some purulent material can be expressed from around the nodules. The nodules deeply infiltrate the normal pancreatic substance. The duct is patent as far as can be followed toward the head.

Liver.—Is large and voluminous, on section presents a grayish green, pale appearance, the substance somewhat greasy to the touch. Near the beginning of the middle lobe and starting in the hilum, around one of the large branches of the left portal vein, the periportal structures are greatly thickened, of a whitish, nodular appearance, a large number of droplets of purulent material being expressed from the spaces around the vein. The vein itself shows roughening and thickening of the intima, which is covered by a thin film of whitish material. The periportal process infiltrates the liver substance bordering on it.

Gall-bladder.—Not remarkable except as before described.

Spleen.—Very large, about twice normal size. Capsule tense, of livid violet hue. On section substance is very soft and diffluent, follicles appear as irregular grayish bodies averaging 2 mm. Trabeculæ not visible.

Kidneys.—Both kidneys show normal amount of perinephritic fat. Capsule strips with slight difficulty leaving a very finely granular surface. On section somewhat pale. Pelvis and ureters normal.

Aorta.—Shows a few yellowish elevated plaques in its lower part.

Anatomical Diagnosis.—Carcinoma of the stomach with ulceration. Carcinoma of the body of the pancreas. Purulent infection of periportal spaces in one branch of vein in liver. General acute fibrino-purulent peritonitis with extensive fat necrosis. Chronic adhesive peritonitis in right hypochondrium and around pancreas. Operation wound and trochar puncture.

Microscopical Examination.—Sections taken from affected regions of stomach and pancreas show a markedly infiltrating carcinoma, in some places it being of an almost pure medullary type, while in others the fibrous stroma is much more marked. Necrotic areas are very abundant, abscess cavities are numerous, polymorphonuclear leucocytes are seen in large numbers, being also found infiltrating the stroma around these areas. The pancreatic substance shows a fairly well marked increase of fibrous tissue between the acini.

Diagnosis: Carcinoma of stomach, infiltrating pancreas and surrounding lymph nodes. Chronic interstitial pancreatitis.

Liver: Section shows very marked fatty infiltration around central veins.

Sinusoids contain many endothelial leucocytes.

Spleen: Follicular structure is almost obliterated. Sinuses distended and filled with fine granular coagulum and containing many endothelial cells and several polymorphonuclear leucocytes. Blood pigment abundant in these cells. Capillaries congested.

Diagnosis: Acute splenic tumor (acute œdema, congestion and hyperplasia).

A summary of the foregoing case history, brings out the rather surprising fact that there were present four of the more grave affections of the upper abdomen existing simultaneously, three of them presumably superimposed upon the fourth.

The primary focus of disease was in all probability the gastric ulcer, which later suffered carcinomatous degeneration, the carcinoma subsequently becoming secondary in the pancreas. This latter organ under the irritating influence of the carcinoma became the seat of a chronic interstitial inflammation.

In a very careful study of the patient, none of these four lesions was suspected, except the pancreatitis which was considered because of the persistent pain in the left lumbar region.

That such profound tissue change could proceed without any manifestation, for a period evidently extending over several months and culminating finally in an attack characterized only by moderate abdominal pain, jaundice and slight fever, is worthy of attention.

There are on record several cases highly suggestive of the same condition, and a comparative study of these case histories leads one to the conclusion that there must exist some interaction of the nervous and chemical relations between the stomach and pancreas by which the effects of disease in one organ are, in a measure, counteracted by a compensatory or sympathetic hyperactivity of its neighbor.

A few typical case reports from the literature follow:

Bode[1] cites one case in a woman of 33 years, who complained for a few weeks of a feeling of abdominal fulness, some loss of flesh and strength. She developed jaundice, enlargement of the liver and retention of urine. On examination the gall-bladder was enlarged and tender, there was slight fever, the urine contained bile but was free from albumin and sugar.

Under a diagnosis of gall-stones, operation was performed; the gall-bladder was found distended with bile, its ducts obstructed from the outside, no stones or adhesions present.

The head of the pancreas was greatly enlarged by a firm, smooth tumor which obstructed the common bile duct at the ampulla. Cholecystduodenostomy was done and the patient discharged upon convalescence.

One year later she again presented herself, much emaciated and with a tumor visible at the site of operation. On section there was found a large, nodular adherent carcinoma of the pancreas firmly adherent to the papilla.

In this case it is doubtful whether a primary carcinoma was present or whether the primary focus was in the ampulla of Vater with secondary

development in the pancreas. Bode thinks it possible that the carcinoma may have developed in an old interstitial pancreatitis.

Syms[2] reports an interesting case in a male twenty-four years of age. For one year there were noticed slight stomach symptoms; three months before these symptoms had grown more severe and were attended with some nausea and occasional vomiting, jaundice developed, with pale stools, the urine bile stained and there was slight fever. On examination there was found a rigid abdomen with tenderness in the epigastrium and marked pain in the upper left lumbar region. Upon operation the gall-bladder was found distended but there was no disease of the biliary system. A firm, nodular mass was attached to the posterior wall of the stomach, extending from behind the duodenum well across the posterior gastric wall. The gall-bladder was drained, but the patient died in four days.

Autopsy showed the gall-bladder and ducts free from disease. There was present a large carcinoma involving the pancreas, the posterior wall of the stomach and the suprarenal on the right side. The jaundice was due to the compression of the duct.

Körte[3] reports a case in a woman of forty-one, who for two years had had indefinite symptoms referred to the stomach, with slight loss of weight. She was suddenly seized with severe pain in the upper abdomen and breast, vomiting and diarrhœa. The abdomen was distended; at the epigastrium, above the umbilicus and a little to the left was a tender, fist-sized tumor, which did not move with respiration and presented a small area of fluctuation. On operation a large abscess was found between the layers of the gastrocolic omentum and attached to the stomach and colon. Its contents were thick pus, particles of fat and necrotic tissue. The wound was drained, the patient dying two months after operation. Autopsy showed a mass of adhesions in the upper abdomen and a well advanced carcinoma of the pylorus, to which is firmly attached the head of the pancreas, which is penetrated by the carcinoma.

It has been proved beyond doubt that a close nervous and chemical relationship exists between the stomach and the pancreas and that if the sequence of this mechanism be altered by disease, changes may result in the function of either or both organs.

According to Howell[4] the order of digestive stimuli in the stomach and pancreas is as follows: the acid of the gastric juice, upon reaching the duodenum produces the material called secretin, which is in turn absorbed by the blood and carried to the pancreas where it stimulates that organ into activity. There is also present and active a nervous mechanism contained in the secretory fibres of the splanchnic and the vagus.

It is perfectly reasonable to suppose that in certain cases of gastro-pancreatic disease the secretory activity of the pancreas may be excessively stimulated by the presence of an irritating neoplasm and may reflexly cause excessive secretion and hence increased peristaltic action on the part of a stomach invaded by carcinoma. The greater secretion of gastric juice, with the increased peristalsis may readily counteract the symptomatic effect of a well advanced carcinoma of that organ. It is some such interaction of function that, in the opinion of the writer, makes possible the clinical expression of the cases under discussion.

Secondary invasion of the pancreas in abdominal carcinoma is not a common occurrence. Willigk [5] in 467 autopsies upon patients dying of carcinoma, found the pancreas involved in 29.

Biach [6] found in the Wiener allgemeinen Krankenhaus in 1270 autopsies in cancer cases that the pancreas was involved in 22. In the Rudolphspital one case of pancreatic cancer was noted in 221 cases dying from this form of malignant tumor.

As to the location of the growth in the gland itself, the head is most frequently involved. Mailand [7] found in 57 cases, the head as the seat of disease in 35, the tail 1, the body 2 and 19 were diffuse throughout the entire organ.

Morallie [8] found in 113 cases of pancreatic cancer, the head affected in 82, the tail seldom involved.

Of the histologic varieties of carcinoma, the glandular type is the most frequent, closely followed by scirrhus.

A point of interest in this connection is whether the primary tumor in the pancreas is really of pancreatic origin, or whether many such growths are not secondary to an overlooked focus in the pylorus or duodenum.

Oliviere [9] in a very careful study, holds that a neoplasm apparently primary in the pancreas may have had its origin in the duodenum, and that only the most painstaking microscopic study can differentiate the two.

Fähndruch [10] in an inaugural dissertation reports several

cases wherein apparently primary pancreatic cancers had their true source in a small tumor in the gastric mucosa.

The conclusions gathered from a review of the foregoing are: that secondary invasion of the pancreas is a somewhat infrequent sequel of pyloric or duodenal carcinoma and that in a certain group of cases, where the pancreas is attacked early in the course of the disease, there may arise a mutual functional compensation between stomach and pancreas, which permits both organs to satisfactorily perform their duties, with a decided absence of symptoms of disease of either, even though there may be extensive destruction of tissue.

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SUBDIAPHRAGMATIC ABSCESS.*

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A SUBPHRENIC abscess may be defined as a localized collection of pus situated immediately below, and in contact with, the diaphragm, or only separated from it by the peritoneum.

In order to better understand the localization of pus in this region a brief review of the anatomical relations of the viscera which occupy it will be of assistance.

If the organs are removed from the abdominal cavity, leaving only the parietal peritoneum, it will be seen that the reflections of peritoneum entering into the formation of the lateral ligaments of the liver, the gastrohepatic omentum, the gastrosplenic omentum, the gastrophrenic and the costocolic ligaments, divide the diaphragmatic area into an upper anterior and a lower posterior part. The space above this transverse chain is divided into right and left anterior spaces, both being intraperitoneal, by the falciform and round ligaments of the liver, while the part below it is divided by the reflection of the peritoneum to the duodenum and the hepatic vessels into a right and left posterior intraperitoneal space, both lying above the transverse mesocolon, but communicating with each other through the foramen of Winslow; the former being known as the subhepatic fossa or the right renal pouch, and the latter, as the cavity of the lesser peritoneum.

H. L. Barnard, in his admirable paper on this subject, pointed out that in the presence of infection the viscera of the upper abdomen would adhere to each other and to the abdominal wall in such a manner as to form the lower and anterior limits of these spaces in which pus could accumulate, forming

* Read before the Philadelphia Academy of Surgery, March 3, 1913.

discrete abscesses, separated from each other and from the rest of the abdominal cavity.

The right anterior intraperitoneal space is bounded, behind, by the right lateral and coronary ligaments of the liver, below, by the upper surface of the right lobe of the liver, the falciform ligament is to the left, while its lower anterior limits are often formed by adhesions between the margin of the liver and the anterior abdominal wall; however, if the infection arises below, as from an anterior perforating gastric ulcer, the lower boundaries of the abscess are formed by adhesion between the surface of the stomach, colon or great omentum to the anterior abdominal wall. The left anterior intraperitoneal space is limited, above, by the diaphragm, behind is the left lateral ligament and the diaphragm, to the right by the falciform ligament, the reflections of the peritoneum entering into the formation of the gastrohepatic and gastrosplenic omentum, below and to the right, by the stomach, which, together with the great omentum becomes adherent to the anterior abdominal wall, shutting the abscess off from the peritoneal cavity below, while to the left is the spleen and the left abdominal wall.

The right posterior intraperitoneal space, or the subhepatic fossa, is overhung by the liver and the gall-bladder, which form its anterior wall behind, it is limited above by the right lateral and coronary ligaments, while, posteriorly is the right crus of the diaphragm and the right kidney; to the left is the duodenum, the bile ducts, vessel to the liver, and the foramen of Winslow, through which this space communicates with the lesser peritoneal cavity; while along the lower margin of the left lobe of the liver in front and the anterior surface of the stomach a narrow communication exists with the left anterior intraperitoneal space. On the right side infection may find its way around the right ligament, as well as around the anterior margin of the liver to the right anterior peritoneal space and below it communicate with the right lumbar fossæ. The left posterior intraperitoneal space, or the lesser peritoneal cavity,

rests upon the left crus of the diaphragm and the pancreas; to the left is the spleen, to the front is the liver, the lesser omentum, and the posterior wall of the stomach; to the right are the duodenal vessels, bile ducts, and foramen of Winslow.

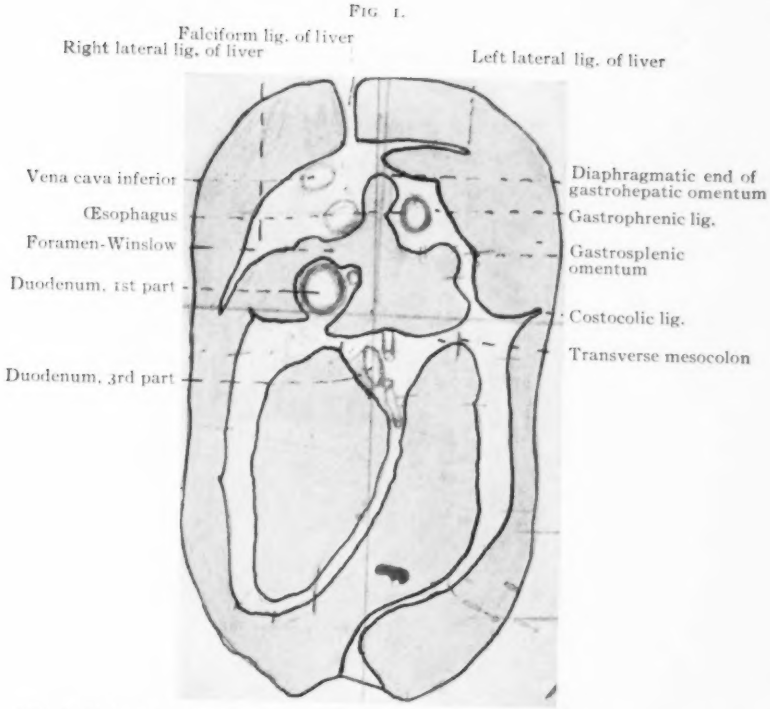
An extraperitoneal subphrenic abscess is formed on either side by infection of the retroperitoneal tissues. On the right side the pus finds its way between the two layers of the lateral ligaments and the coronary ligament, thence forward to the falciform, often as far as the umbilicus, while on the left side the pus dissects up the peritoneum from the surface of the diaphragm in order to make room for the abscess between them.

Etiology.—Subdiaphragmatic abscesses may be, but are seldom, primary. They usually follow some lesion producing direct contamination of the peritoneum in this situation, or by the extension of a suppurative process distally situated, either by contiguity, continuity, through the lymphatic vessels or through the blood currents.

The most frequent cause is probably perforation of gastric or duodenal ulcers, while infectious processes occurring in the abdominal or thoracic organs are common, among which, in the order of frequency, are appendicitis, suppurative conditions of the gall-bladder, liver, pelvic organs, thorax, and spleen. They occur in septicæmia and pyæmia. In one of the cases reported here it was tubercular, secondary to a thoracic lesion.

Symptoms.—The previous history is usually that of the condition which ultimately gives rise to the abscess. If it originates from a gastric or duodenal ulcer, a history of digestive disturbance, pain associated with the taking of food, etc., would likely be obtained. The onset may be sudden or insidious; if intraperitoneal it is apt to be acute and violent when due to a perforating ulcer, but not always, as it may be subacute when the ulcer perforates through a small opening. During the course of a septic condition the formation of the abscesses may be largely masked by the preponderance of

FIG. 1.



After Delépine, showing lines along which the peritoneum leaves the abdominal wall to invest the viscera. (From Gray's Anatomy, page 1269, Fig. 876, 17th edition. By Da Costa and Spitzka.)

these processes. The amount and character of pain are variable; it is generally present early, at the site where the abscess ultimately forms.

Tenderness and rigidity accompany the onset of a local peritonitis, but as the abscesses become walled off they lessen to some extent. The temperature in these cases, if the abscess is well localized, may be very slight, but sooner or later it becomes septic in character, and may be accompanied with rigors and sweats. The patients become anæmic, lose weight and strength rapidly; often their only complaint is extreme weakness. Leucocytosis is always present, but varies with the degree of the infection and the resistence of the individual. In about two-thirds of the cases an abdominal mass can be detected; it is dull to percussion, tender and firm if due to inflammatory tissue; while signs of fluctuation, slighter tenderness; and sometimes tympany is present, if the pus is due to a gas-producing organism. Displacement of the liver depends upon the formation of a line of adhesion between the liver and the anterior abdominal wall, which is usually the case, when the infection progresses from the posterior part of the upper surface of the liver to its anterior margin, in this case the liver does not descend with respiration.

As pus accumulates between the liver and the diaphragm the lung is displaced upward and more or less compressed, thus giving rise to altered physical signs at the right base, and sometimes accompanied with the plastic or serous pleurisy or a localized bronchitis. However, if an abscess is situated in the right intraperitoneal space and the line of adhesions does not form between the liver and the abdominal wall, or the abscess originates below the liver margin it would assume a triangular shape which would extend from the ensiform process to the umbilicus by a line convex to the left representing the falciform ligament and from there to the right costal margin. In an abscess situated in the corresponding space on the left side, the mass would have its right boundary convexed

toward the right, while its left boundary would extend from the umbilicus to the left costal margin, and the left base would be the situation of the altered physical signs.

Should the abscess be localized in the subhepatic fossa, there would be tenderness and rigidity below the costal margin, extending downward and posteriorly toward the crest of the ilium.

If the lesser peritoneal cavity is the situation of the abscess the diagnosis becomes more difficult; an accumulation of pus here may present forward in one of several places, between the stomach and liver, the stomach and colon, the stomach and spleen, or below the colon. Altered physical signs at the left base are sometimes present.

Right-sided extraperitoneal subphrenic abscesses are caused most frequently by retrocolic appendicitis, infections of the liver, pancreas, or the kidneys.

The onset of the symptoms is associated with the systemic evidences of infection and are usually gradual. There are, of course, no symptoms of peritonitis, very little if any pain or tenderness, as these retroperitoneal spaces may be considered silent areas, just as infectious lesions of the brain or liver substance give rise to little or no pain; when, however, the abscess extends into the lumbar region, or advances along the falciform ligament anteriorly, tenderness is more easily elicited. In the latter the abscess may point in the middle line between the ensiform cartilage and the umbilicus, and be open in this situation without entering the peritoneal cavity. The signs at the right base are only marked in a well developed abscess, if the left lateral ligament is invaded; the left base may also show altered physical signs.

The left extraperitoneal subphrenic abscess, originates usually from the kidney, pancreas or spleen, and is apt to present in the lumbar region, but occasionally it dissects the peritoneum from the under surface of the diaphragm, under which circumstances there may be tenderness in the right

hyphochondrium, with symptoms of compression of the left base.

Three of the following cases occurred at the Jefferson Hospital in the service of Doctor John H. Gibbon, to whom I am indebted for the privilege of operating upon them and of reporting them.

CASE I.—A woman, sixty-three years of age, who had been ill for six weeks with what had started as gall-stone colic. She commenced to have fever soon after the onset of the illness and for the four or five days preceding the operation had rigors, with a temperature of 104° to 105°, followed by sweats. The patient was evidently very ill, and upon examination there was found a diffuse cellulitis extending over the lower part of the thorax, the right side of the abdomen as far as the umbilicus, and spreading from there to the right iliac crest and loin. A little to the right of the costoxyphoid angle there was a fluctuating area about two inches in diameter.

An anæsthetic was administered and an incision made over this fluctuating area which liberated a large quantity of pus. A sinus was found leading through the abdominal wall to a secondary abscess in the subhepatic fossa, containing between a pint and a half and two pints of pus. On account of the extensive cellulitis it was not deemed wise to open the general peritoneal cavity, and after placing a gauze pack covered with guttapercha tissue at the base of the gall-bladder, the operation was terminated. There were no gall-stones liberated with the pus and none discharged afterward. The patient made an uneventful recovery and is reported to be well at this time, some eighteen months after the operation.

There is some doubt in regard to the origin of this infection, but I am inclined to believe that subhepatic fossa became infected from a cholecystitis and from there the infection spread to the right anterior intraperitoneal fossa around the anterior margin of the liver.

CASE II.—W. C. F., age thirty-three, male. The family and previous history had no bearing upon the present illness. On August 9, 1911, the patient was seized with very severe pain in

the region of the gall-bladder, which radiated to the right shoulder. He was nauseated but did not vomit until after salts had been administered to him. He was admitted to the Medical Ward of the Jefferson Hospital, August 11. At that time he complained of a dull, aching pain over the gall-bladder, much less severe than at the onset; temperature 100 3/5°, pulse 106, and a leukocytosis of 18,400. I saw the patient August 15. At this time his temperature had fallen to 99° and the leukocyte-count was 10,600; the pain was described as much less tender upon physical examination. By deep palpation a moderate amount of tenderness was elicited in the region of the gall-bladder, still less over McBurney's point, and no appreciable rigidity of the recti muscles. I concurred in the diagnosis of cholecystitis, which was subsiding, and advised his transfer to the Surgical Ward.

On August 18, his leukocytes rose to 14,600, and the following day he was sent to the Surgical Ward. I saw him on the morning of the 20th. At this time a distinct mass could be felt reaching a little above the level of the umbilicus on the right side. I then felt that we had a high posterior appendix to deal with and operated the same day. Upon opening the abdomen the gall-bladder and ducts were normal, but the ascending colon was pushed forward by a mass behind it and was bound down by adhesions to the outer side. The general peritoneal cavity was packed off and the adhesions broken up, liberating a moderate amount of pus; a necrotic appendix was lying behind the colon and reaching high up toward the gall-bladder, this was removed and the abscess drained through the rectus wound, posterior drainage was not thought necessary.

Following the operation the patient ran a slightly elevated temperature, going as high as 101°, but became normal on the 10th day. From then on it gradually rose again and by the twenty-fourth day assumed the septic type, accompanied by chills. Frequent examination failed to find a reason to justify further operative interference. The patient had several chills on succeeding days, and continually lost weight, and, while there was no pain, he complained constantly of great weakness. The wound continued to discharge pus rather freely and on the forty-third day after the operation friction sounds were heard at the right base, two days later it was evident that a pleural effusion existed.

The patient died of exhaustion on the forty-seventh day following the operation.

Autopsy.—Pleura: On the right side shows a few adhesions at the apex; the cavity contained 60 c.c. of slightly blood-tinged fluid.

Peritoneum: To the right of the umbilicus the intestines were knotted together by numerous adhesions, which were separated with difficulty; these extended up to the under surface of the liver, and when broken up, this region shows numerous small pockets of pus, a large pocket behind the ascending colon communicates with a sinus in the abdominal wall, a branch of this sinus extends up the muscle in the abdominal wall for a distance of 10 centimeters. The liver extends two finger's breadth below the margin of the ribs in the midclavicular line; the liver is normal in size, somewhat soft in consistency. On the posterior surface of the right lobe there is a necrotic area 13 cm. in diameter and 1 cm. deep; it is covered by shaggy, grayish-yellow tissue, posterior to the gall-bladder and between the right and the left lobe the finger can be passed up into the liver tissue into a cavity 5 cm. in diameter, filled with necrotic material and pus.

Kidneys: The right kidney measures 13 x 5 x 4 cm. and resembles its fellow except that at the right upper pole, anteriorally, there is a necrotic area 5 cm. in diameter and 5 cm. deep. The cavity in the liver and that just described in the kidney constitute respectively the top and the bottom of a retroperitoneal abscess; while it probably communicated with the sinus mentioned above. This was not demonstrated owing to the fact that the abscess was not thought to exist and was only discovered on removing the kidney after all of the normal relations had been disturbed. The abscess had apparently started in the retroperitoneal tissues, gradually invading both the liver and kidney. Its situation marked so accurately the point of greatest tenderness that I am of the opinion that the infection occurred here early, but probably from the escape of pus through the sinus it failed to reach sufficient size to give the distinctive signs.

Case III.—A woman, seventy-one years old. She had been conscious of a pain in the right lower abdomen for the past month and for the last two weeks had been unable to extend her right thigh; five days before admission she discovered a large mass in the region of the cæcum; for the last three days she had had chills followed by sweats.

Upon admission to the Jefferson Hospital, Aug. 26, 1911, the temperature was 101 3/5°, pulse 120, respiration 20; physical examination showed a large tender mass in the right iliac

region. Operation was performed, shortly after admission, through a Kammerer incision; a large appendiceal abscess was opened and a rather long retrocolic appendix was removed. The abscess cavity was then drained through the anterior wound.

The subsequent course of this patient very closely resembled the other appendix case, just described; the temperature gradually became septic in character and the patient lost weight and strength. Frequent physical examination failed to disclose any accumulations of pus or evidence of peritonitis; drainage from the original wound was still quite free.

The day following the autopsy on Case II, I determined to establish posterior drainage in this case and to explore the region in which the abscess had been found in the previous case. Using the triangle of Petit as my point of entrance I connected this with the original wound but failed to find that this liberated any accumulation of pus. I then passed a long curved pair of hæmostats up the outer border of the right kidney, to its upper pole, and in this region, or a little beyond, entered an abscess containing about five ounces of pus. The hæmostats were admitted their full length without meeting with any resistance; the lower end and posterior margin of the liver could be felt in the wound, so that the abscess must have been in, approximately, the same position as in Case II. The patient's temperature gradually fell, reaching and remaining normal on the tenth day; her recovery was uninterrupted although slow, probably due to her advanced age.

Case IV.—A lad, seven years of age, had complained of pain in the left hypochondrium for the last fifteen months; recently the parents noticed a protrusion of the ribs on that side. Upon admission, Aug. 20, 1912, the left side of the thorax was found to be distinctly bulging from the seventh to the eleventh rib in the anterior axillary line; the breath sounds over this area were normal but by deep palpation a mass could be felt, about in the position one would feel the spleen or a little above it. The radiogram showed a shadow in this position and also showed evidence of tuberculosis in the lungs, consisting of an increase in the amount and the density of the fibrous tissue.

Believing that I had an extraperitoneal subdiaphragmatic

abscess to deal with, I determined to avoid, if possible, having the drain pass through either the pleura or the peritoneum.

The abdomen was explored through a left-rectus incision just below the costal margin revealing a mass above, and anterior to the spleen; this was walled off from the rest of the abdomen by gauze packs and a second incision made through the skin just below the ribs in the left flank; the peritoneum was exposed, then with a finger in the abdomen as a guide, the peritoneum was dissected from the diaphragm through the second incision until the abscess was broken into. The abdominal wound was then closed by an assistant who had remained clean for that purpose. The abscess was then explored and found to extend to the region of the cardia, and to penetrate the diaphragmatic muscle a little to the inner side of the left nipple line and well posterior, but did not communicate with the pleura or the peritoneum. Drainage was established by means of rubber tubes and the patient's convalescence was uneventful.

Treatment.—The treatment of subdiaphragmatic abscesses consists primarily, in establishing drainage. If a mass presents in front it should be reached through an abdominal incision without opening the general abdominal cavity if possible, or if this danger cannot be eliminated, the peritoneum should be opened below the abscess and the general cavity protected by gauze before evacuating the abscess. If the abscess is situated in the subhepatic fossa or is retroperitoneal on either side, it can be reached through a loin incision alone, or in conjunction with an abdominal incision through which the lower limits of the abscess can be determined and the dissection which is conducted through the loin incision aided and guided to the abscess without opening into the peritoneum. This accomplished the abdominal wound can be closed by an assistant who has remained clean for the purpose.

If there is reason to fear that the peritoneum may be entered in the effort to reach the abscess the intraperitoneal site may be walled off from the general cavity of the peri-

toneum by gauze packs introduced through the abdominal wound.

When the physical signs are well marked at either base the lung is apt to be displaced upward and the diaphragmatic and parietal layers of the pleura are frequently adherent, or in contact, so that they may readily be united. Under these circumstances the transpleural route is thought, by some, to be the best. This may be conducted in two stages, the first of which consists in resecting a rib, or ribs, and uniting the pleural surfaces and a day or two later exploring beyond these.

It is permissible to precede this operation by an exploring needle, provided the operation is to follow at once, keeping in mind the danger of infecting the pleural cavity; this danger may be lessened by leaving the needle in place until the pleura is incised and, if necessary, the two surfaces united by sutures.

This method has the very great disadvantage of endangering the pleura, both to the infection or to the formation of pyopneumothorax, and the difficulty in some cases of maintaining adequate drainage. On the other hand, there are very few subdiaphragmatic abscesses that cannot be dealt with satisfactorily by one or the other method, that is, by direct incision, as in my first case, or by a loin incision, and when necessary associated with an opening in the abdomen.

In reviewing the reported cases, it would seem that the intraperitoneal abscesses form pus much more rapidly than the extraperitoneal ones do, the physical signs are detected earlier, tenderness and rigidity are apt to be present and well marked, even if the abscess has not reached large proportions, the infection is less apt to pass beyond the original limits of the abscess and thorough drainage is more easily accomplished.

The retroperitoneal abscesses are more insidious in their onset, are detected with greater difficulty, the infection is liable to extend far beyond the walls and into region where it is impossible to follow.

In neither of the extraperitoneal cases, II and III, was it possible to make a positive diagnosis of abscess, and had I not

witnessed the autopsy on the former of the cases I should have not sought the abscess in the latter. In those cases where abdominal infections are known to exist, which progressively grow worse, and especially those that have come to operation late, I believe that we are justified in exploring the retroperitoneal subdiaphragmatic area on what would otherwise be slight evidence, that is persistent localized tenderness, accompanied by altered physical signs at the corresponding base.

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EXPERIMENTAL ANATOMIC AND PHYSIOLOGIC OBSERVATIONS BEARING UPON THE TOTAL EXTIRPATION OF THE COLON.*

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WHEN we consider the arrangement by which 20 or more feet of small intestine are being supported through a peritoneal attachment measuring five inches (vertebral border of mesentery); when we think of the inguinal region as the lowest and weakest portion of the abdominal wall, and the frequency with which hernias result from the gravitation of abdominal contents against this lowest and weakest point; when we examine the costal arrangement by which it becomes necessary in respiration to raise the costal cage against gravity; when we compare the darkened lungs of the human subject with the clean pink lungs of the quadruped living under the same conditions as a proof of how unequal the cilias are in their efforts to lift the dirt and bacteria laden mucus against gravity; and when we watch the pathetic efforts of the tubercular subject to raise against gravity his expectoration, we get the full swing of the disadvantages of the upright position.

These are but a few of the disadvantages as pointed out by Pohlman, and more fully set forth by Wiedersheim in his excellent work, "Der Bau des Menchen."

That man advanced in the evolution we freely concede, but we must not be unmindful of the price that was paid for the advancement, and that will continue to be paid until, through the natural process of evolution or some artificial means, a better adaptation to the condition can be arranged. The work of Mr. William Arbuthnot Lane, which has extended over a period of more than ten years, and his writings

* Read before the Southern Surgical and Gynæcological Association, December 18, 1912.

of the last few years have done more to arouse an interest in this subject than anything else excepting the work of Elias Metchnikoff, who through his investigations upon the bacterial flora of the intestine has aided independently and deserves to share with Mr. Lane the credit of this awakened interest. Mr. Lane's proposal and the procedure which he for ten years has followed, namely, the removal of the entire colon in properly selected cases, where the sewerage functions of the large intestine are inadequate and unsatisfactory, has in a measure staggered the medical world through its seemingly heroic nature. We are inclined to suspect that in many instances the consideration of the subject ended with this initial surprise and a prompt condemnation of the proposal. The question hinges upon the correctness of the premises and not upon our impression as to whether or not we believe the procedure to be heroic.

Just about 100 years ago the medical world ridiculed and doubted the performance of McDowell in the removal of an ovarian tumor. An operation considered in the light of that period was far more heroic than the removal of the colon considered in the light of the present developed state of intestinal surgery.

Direct observations of Mr. Lane's work at Guy's Hospital, almost two years ago, gave me the impression, which in time grew to a conviction, that Lane's procedure was here to be reckoned with, and it only remained for time and experience to define its limits and perfect its details.

Its reception will doubtless be a stormy one. It will always remain an operation that deserves to be carefully considered and painstakingly performed.

Mr. Lane has been accused of being too radical. This is not at all unreasonable. The natural place of a leader is in advance of his followers, and in this movement Mr. Lane undoubtedly occupies the position of leader.

The technical difficulties that attend the operation are several.

Shall the ileum be connected with or without the additional step of colectomy? Shall the attachment be made end-to-end, side-to-side, or end-to-side? To these belong the difficulties of properly selecting the cases suitable for the procedure and the operative details common to every intra-abdominal operation, as minimizing adhesions, avoidance of shock, and lastly, infection directly or indirectly through imperfect suturing.

A series of experiments upon dogs was conducted by the writer with the hope of possibly shedding a little light upon the debatable operative side of the question.

To avoid too much encroachment upon time and space we omit details of each experiment.

Only those methods were tried that seemed desirable, namely, side-to-side, end-to-end and end-to-side. The invagination was tried in the end-to-end because it seemed suitable in view of the smaller circumference of the small intestine as compared with the receiving lumen of the large intestine.

The end of the small intestine was placed parallel with the end of the large intestine and one-half of the circumference united by means of a through-and-through stitch with the corresponding half of the large bowel.

The traction sutures, the one at the mesenteric attachment and the other at the opposite point, were introduced from within, securing a good, strong purchase at these points and leaving the one end of each suture long and armed with a milliner's needle. The needles were pushed through the wall of the large intestine at a point about 2 inches beyond the line of suture, and used to aid in effecting the invagination. Following this the remaining half was closed by means of a Connell stitch. By pushing upon the small intestine from above, and pulling from below by means of the traction sutures, an invagination was effected, bringing broad peritoneal surfaces together.

The invagination was made permanent by the application of two continuous seromuscular sutures, one for each half of the intestinal circumference. The traction sutures were severed close to the intestinal wall, while traction was being made which resulted in the disappearance of the end within the lumen of the intestine. The minute punctures were touched with 95 per cent. carbolic acid, followed by alcohol, and buried by one or two Lembert sutures.

Lateral anastomoses were made in two ways: in the one the blind end was left needlessly long beyond the opening in the proximal limb; and in the other this was reversed, *i.e.*, made as short or without any blind

end propecting beyond the anastomotic opening in the proximal limb. Otherwise the lateral anastomoses were made in the usual way.

In the end-to-side, two methods were tried. In the one, the proximal end was invaginated into the side of the distal limb through two mattress sutures after the method of Jesset, and the invagination made permanent and secure through a continuous Lembert suture applied separately to each half of the circumference of the invagination.

FIG. 1. FIG. 2.

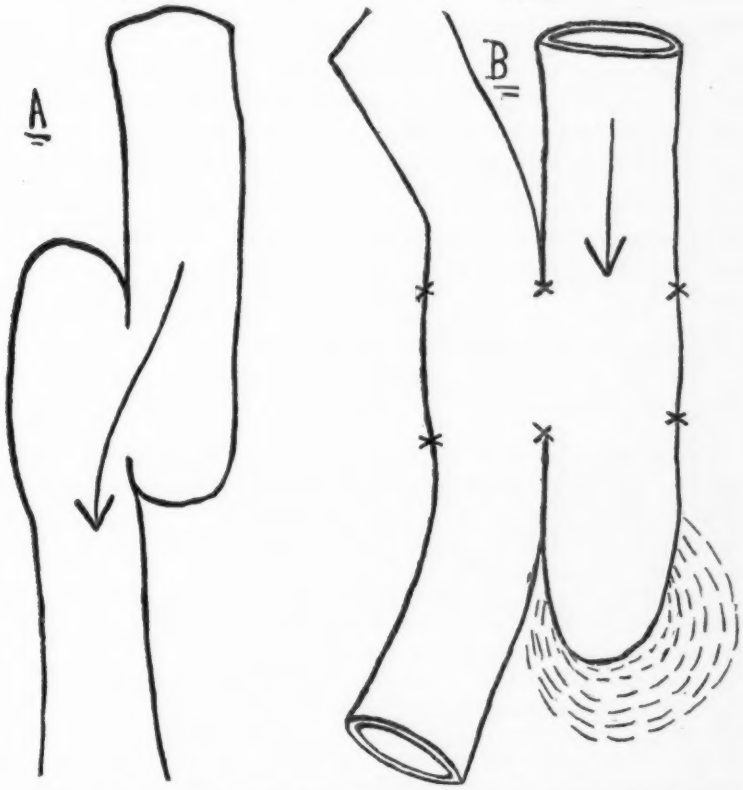


Fig. 1.—Showing tendency for the two sections to pull into a straight line in a lateral anastomosis when there is no excessive overlapping.

Fig. 2.—Showing tendency of the blind end of the proximal limb to become distended beyond the opening where an excess of overlapping exists.

NOTE. X, X, X, X, the dead areas of the intestine due to the division of the circular fibres.

The other end-to-side connection was performed according to the usual method of connecting the duodenum to the stomach or a lateral anastomosis, namely, an outside row of seromuscular sutures and an inside row of through-and-through sutures.

The experiment to which I wish to direct especial attention is the

following: In a moderate sized brindle bull dog the mid-point of the descending colon was divided. Its distal end was closed by invagination, and its proximal end brought through and sutured to the peritoneum in the mid-line. The end beyond this peritoneal line of suture was passed between the separated fibres of the left rectus in its middle and made to emerge on the surface at a point about one inch external to the outer border of the rectus. An ileorectostomy was made between the ileum, four inches beyond the valve, and the large bowel as near the anus as conditions would permit. The ileorectostomy opening was about two inches, which for the size of the animal was unusual.

It will be seen that an effort was made to favor the passage of the intestinal contents through the anastomosis and in the natural way through the short rectum by making the opening large and the distance between the anastomosis and the anus short, the line of least resistance.

On the other hand, an effort was made to retard the passage through the other course by compelling it to pass the ileocæcal valve, traverse the greater distance, and overcome such resistance as the above described arrangement at the artificial anus would offer. The result was that practically all the movements passed through the ileocæcal valve, traversing the longer distance, overcoming the obstacles in the abdominal wall; and were discharged through the artificial anus instead of the natural one—the gastro-enterostomy story over again.

The few movements that passed the natural anus were fluid or semi-fluid with minute evidences of blood for at least 11 weeks after the operation.

Those that passed the artificial anus were formed and had the appearance and consistency common to the normal movement of a dog. The nutrition of the dog for six weeks was impaired. This was attributed more to the habits of the dog to lick his wounds. We were not entirely successful in preventing this.

The local disturbance and impaired function at the site of the anastomosis played the principal part in the interference with his nutrition. His nutrition finally returned to normal.

Such movements, few in number, and at times only that passed by the natural anus, were indicative of a proctitis at least up to 11 weeks following the procedure. The other dogs did not show any indication of an interference with the nutrition. If there was any undue thirst, we failed to observe it. The movements were all semisolid at the beginning but without any indication of proctitis or other inflammatory disturbance such as occurred in the dog with the artificial anus. In the course of about two weeks, the movements became formed. Up to three months after the anastomoses they remained formed but were never in that desiccated state common to the movements of this animal.

The end-to-end union gives the most perfect functional results (Cannon and others).

The chances for infection when carried out by any of the

end-to-end methods are considered greater than those that attend the lateral anastomoses or an end-to-side as usually performed.

The end-to-end may in time be so perfected that its risks from infection will be no greater than those that attend the lateral effort. In the *Transactions of the Thirty-seventh German Surgical Congress,* Moschowitz describes a set of instruments for controlling or at least minimizing the risks of infection from the intestinal contents.

While the simple needle and thread should do the work, further improvements in the prevention of the escape of intestinal contents or the exposure of the intestinal mucosa are desirable.

With a given number of operators of varying experience, the immediate results of a lateral anastomosis would likely be in favor of the lateral method.

The particular advantages ascribed are that it is easier to secure the approximation of serous surfaces in this than in the end-to-end.

Furthermore, the difference in the sizes of the joining limbs present no obstacle. The chief disadvantages of the lateral method seem first that it is practically a triple operation.

The secure invagination of the ends where two ends are to be dealt with, is not always quite so simple nor as rapid as we sometimes would like.

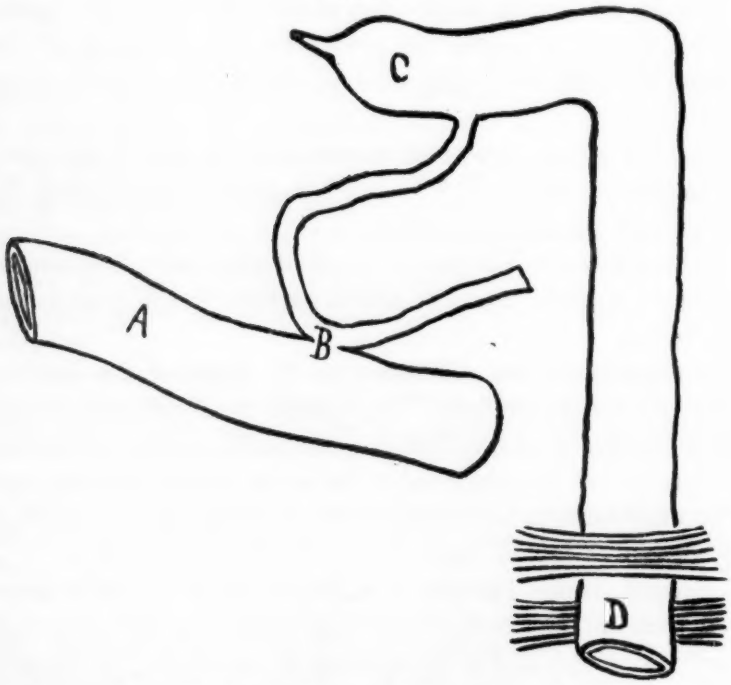
Second, if the opening is a large one, we have a large dead area as the result of dividing a corresponding section of circular fibres, and if the opening is a small one, the danger of the opening becoming in time insufficient, is not altogether imaginary. The liquid character of the contents of the ileum reduces this danger to a minimum. The blind end beyond the anastomosis if it exists will in time undergo dilatation and may become a source of disturbance. If the anastomosis is made snug, *i.e.*, without any projecting blind ends, a favorable change occurs in the every increasing tendency of the two limbs pulling themselves in a straight line

which results in a condition not unlike the end-to-end anastomosis.

The end-to-end union performed in the usual manner, has practically all the advantages of both without the disadvantages of either.

The symptoms and signs of intestinal stasis as well as the pathologic anatomy, have been presented by several writers in the recent current literature.

FIG. 3.



Ileorectostomy with artificial anus. *A*, rectum; *B*, ileorectostomy; *C*, cæcum; *D*, artificial anus just beyond the separated fibres of the rectus muscle.

We forego repeating what is clearly set forth by Mr. Lane upon the pathology and the complete clinical report by Mr. Chapple of the end results of 50 cases. These two papers can especially be commended, as they represent the views as expressed by Mr. Lane and his associate. (*British Med. Jour.*, April 12, 1911.)

According to Gerster and others, the bands and membranes are due to a colitis and pericolitis, the result, as Pilcher expresses it, of a long-continued, or oft-repeated mild infection of the peritoneal covering. It is, we believe, beginning to be realized that while the bands do support they also more or less interfere. It seems fair to assume that the arrest for an undue time of the bacterial-laden contents of the large bowel, especially where there is an abundance of moisture organisms and lymphatics, as in the cæcal region, that the continuance of such a condition for a long period will result in permanent changes.

The work of Metchnikoff plainly suggests the chemical side of the question, *i.e.*, the chemistry of the large intestine when its functions are for any length of time interfered with. Efforts are being made to solve the ill effects of the prolonged retention along these lines.

Systems of gymnastics are being worked out with the view of favorably influencing this condition, supplemented with bandages which add to the comfort and aid in maintaining a support of the blood pressure. The influence of an abnormally movable kidney as a factor in the development of splanchnoptosis has not received the attention it deserves. Few of us, perhaps, realize that the retroperitoneal position of the kidney when making excursions enables it to dissect loose through attrition the peritoneal attachment that served to anchor the viscera to the vertical column.

Gerster, whose opinions are deservedly worthy of careful consideration, expresses himself as follows:

"Prevention has a wide field of usefulness, especially here in America, where chronic colitis is almost endemic. A reasonable restriction of animal food will control putrefactive processes; a generous and daily use of fresh vegetable matter in the shape of well cooked and attractively seasoned dishes, will supply bulk and friction needed to induce normal and adequate peristalsis. The practice of what may be called 'physiological intestinal discipline' should be inculcated from

infancy and should become as much a part of personal hygiene as are ablutions and baths."

In closing, I wish to emphasize that the problem is comprehensive enough to accept all the assistance it can through gymnastics, bandages, regulation of diet and habits and still furnish an abundant per cent. of human wreckage, as Mr. Lane expresses it, for the surgeon to attempt to reclaim.

I wish to convey my thanks to Dr. Benjamin J. Lammers and Mr. Morris Flexner for valuable assistance rendered me in this work.

NOTE.—Since the meeting of the Southern Surgical and Gynæcological Association, held December, 1912, I have received a communication from Mr. Lane defining his position upon the question of intestinal stasis and cholectomy. In view of the growing interest in this question, I deem it fair and proper to append with his permission, his views, as follows:

"I do not think my treatment has changed. I believe that if the patient is at all wasted, and the colon is distinctly static, it is far better to remove the large bowel. In other words, when the removal of the large bowel exposes the patient to but little added risk, I prefer to remove it. The result of removal is far better than that of short circuiting. At the same time, I do a great number of operations of short circuiting, namely, putting the ileum into the pelvic colon immediately below the last kink for tubercule, rheumatoid arthritis, Still's disease, neuraglia, changes in the thyroid associated with stasis, as exopthalmic goitre, diverticulitis, etc., for which cholectomy is not called for. If in these cases I get trouble subsequently in the cæcum, which is rare, I remove the large bowel. I do a large number of short circuitings, as the conditions benefited by it in an extraordinary manner are *very numerous*. Those calling for removal of the large bowel are comparatively rare. I have not lost a patient in my female ward at Guy's Hospital from short circuiting or from removal of the large bowel for, I think, three years. Men are more difficult and perhaps more dangerous."

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DIVERTICULITIS OF THE SIGMOID.

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THE development of the recognition of diverticulitis of the intestine as a definite clinical disease with its own pathology and symptomatology is of considerable interest. The existence of diverticula of the intestine has been known for over a hundred years, but less than ten years ago in *Nothnagel's Encyclopedia* (edition 1904) in writing of acquired diverticula of the intestine the statement is made "as these lesions are chiefly of anatomic interest and have very little clinical significance, only a few general remarks will be made on this question."

Sixty years ago Virchow [1] described areas of localized peritonitis occurring on the colon and causing adhesions. This inflammatory process he considered to be due to constipation. For many years little attention was paid to these observations. In 1889, Windscheid [2] reported three cases of acute inflammation of the ascending colon. Graser [3] ten years later was the first to prove the relationship between diverticula of the colon and these inflammatory processes of the intestinal wall.

In 1904 Beer,[4] in an admirable article and review of the then meagre literature almost entirely in the German medical journals, called attention to the relation between the various pathological reports and clinical findings. In 1907 Brewer [5] reported on six cases of left-sided abdominal suppuration, in two of which the direct relation between diverticula and the inflammation were demonstrable, in the other cases problematical. In the same year Mayo [6] reported five cases and collected eighteen cases from the literature, and in 1908 Telling [7] analyzed reports of one hundred and five cases.

Since then there have been numerous reports of cases in the literature, several articles coming from the St. Mary's Clinic in Rochester, the most recent of which by McGrath [8] reports on twenty-seven cases.

The reports of these cases of diverticulitis of the intestine are frequently from autopsy records, or from operative findings when the operation has been performed for some other condition, or after an incorrect diagnosis. Charles Mayo [9] reports making a probable diagnosis in seven of the twenty-seven cases reported. In some cases where resection of the sigmoid has been done for carcinoma, a preëxisting diverticulitis has been found, probably as an etiological factor. Also, it has not been very rare in the past to see in the large general hospitals cases of apparently inoperable carcinoma of the sigmoid where perforation with resulting abscess has occurred; and after drainage, with or without development of a fecal fistula, the symptoms of carcinoma have disappeared.

Because of these facts, the history of the following case is reported as a typical case of acute diverticulitis, the history, symptoms, and physical signs being sufficiently pathognomonic to enable a diagnosis to be made before operation:

C. G., male, aged forty, referred to the writer January 8, 1912, by Dr. J. F. Bell.

His family and previous personal history have no bearing on the present condition beyond the fact that he had always been troubled with flatulence.

The first symptoms of the present illness appeared two years ago, when, after exposure to cold and wet while duck shooting, he was attacked by severe colicky pains in the abdomen, most severe in the left iliac region. Six months before the present attack, while on a train, had a similar seizure. He was ill for ten days, his temperature during this time ranging between 100° and 101° F.

Three days before the operation he had another attack of colicky pain, most severe in the left iliac region. His bowels moved with catharsis, but movements of the bowels or the pas-

sage of gas caused pain in the region of the sigmoid. There was also present an irritability of the bladder, and micturition caused pain in the lower abdomen. On January 7, the temperature was 100° F., pulse 108, leucocytes 13700, with 76 per cent. of polynuclear cells. The following day temperature was 103° F., pulse 120, leucocytes 21000, with 88 per cent. polynuclear cells. A high enema was given after he entered the hospital, without result.

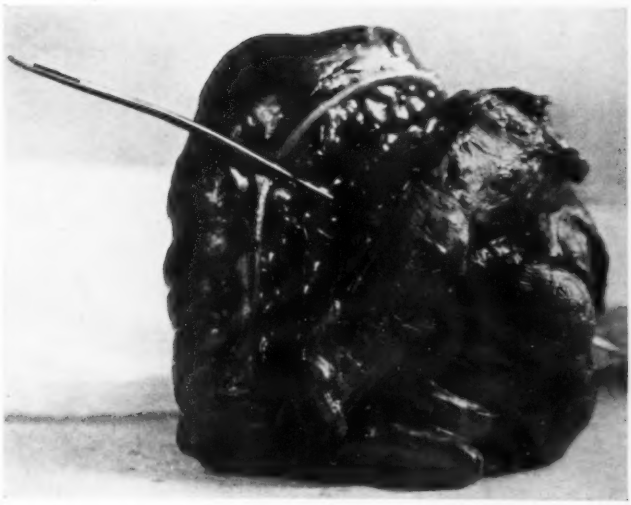
Physical Examination.—The patient was a well-developed, muscular man, 6 feet 3 inches tall. Abdominal examination showed nothing but moderate rigidity, tenderness, and an indefinite resistance suggesting a mass in the left iliac region. With the finger in the rectum, however, this mass could be definitely made out bimanually, just above the prostate and to the left side, apparently adherent to the posterior bladder wall.

A radiograph was taken after a high enema of bismuth had been given. This showed a narrowing of the sigmoid flexure, but there was no complete obstruction anywhere in the colon.

From this data a probable diagnosis of diverticulitis of the sigmoid was made, and an immediate operation advised.

Operation confirmed the diagnosis. There was a marked thickening of the whole sigmoid flexure which, with the mesosigmoid, was adherent to the posterior bladder wall, thus accounting for the pain in the lower abdomen on micturition. In the mesosigmoid there was a thrombosis of the vessels, and an abscess had developed in the thickened mesosigmoid. Because of the thrombosis and damage to the mesosigmoid, a resection of the sigmoid and removal of the inflamed mesosigmoid was done, and an end-to-end anastomosis by suture was performed. A large rubber dam drain was inserted between the point of anastomosis and the posterior bladder wall. The reason for doing the end-to-end anastomosis, rather than performing the resection by the Mikulicz three-stage method, or the Bloodgood method of anastomosis, was due to the facts that the area resected was so low in the sigmoid, and the distal segment which had been adherent to the bladder wall so œdematous and swollen that the distal segment could not have been brought out of the wound, and these two methods of treatment were impossible. Also, immediate anastomosis was not contra-indicated, as there was no acute obstruction present, but perhaps an anastomosis by the

FIG. 1.



Diverticulitis of sigmoid. Intestine has been split open opposite mesenteric border. Probe passes through opening of diverticulum into abscess in greatly thickened mesosigmoid.

method of invagination of the upper into the lower segment, might have lessened the chance of a fecal fistula.

Five days after operation a fecal fistula developed, which slowly closed, leaving a small sinus which occasionally discharged gas, but this closed in July, and the patient now, more than a year after his operation, has no trouble except a slight weakness in the wound, where a small ventral hernia is developing. The bowels move naturally, without catharsis, once or twice a day.

Examination of the specimen removed showed a small opening in the mucous membrane of the intestine, through which a probe could be passed into the thickened mesentery, as is shown by the illustration. Microscopical examination proved that the margin of this opening was lined with epithelium, and the report from the pathologist was "diverticulitis of the sigmoid." (See Fig. 1.)

Articles on this subject within the past few years by Wilson and MacCarty,[10] Giffin and Wilson,[11] Wilson,[12] MacCarty,[13] Wilson,[14] Mayo,[9] McGrath[8] (all from the St. Mary's Hospital in Rochester); Rowlands,[15] Taylor and Larkin,[16] Cameron and Rippman,[17] Hartwell and Cecil,[18] Bruce,[19] Telling,[20] Barbat,[21] Abbott,[22] Erdmann,[23] and Powers[24] make more than a brief review of the etiology, symptoms, and treatment superfluous.

Etiology.—Diverticulitis is said by Telling[20] to be twice as frequent in men as in women. While the condition has been observed in children (Ashhurst,[24] Hartwell and Cecil[18]), it is more frequent in the later decades of life. As to the direct causation, while many theories have been advanced little has been proved. An inherent or congenital weakness in the musculature of the intestinal wall seems to be the most probable predisposing factor, this weakness existing in relation to the points of exit of the veins in the intestinal wall. Obstruction to the return flow of blood in the mesenteric veins has been supposed in some cases to be a cause of this weakness. Traction on the mesentery has been suggested as a cause of weakness in the small intestine, as

diverticula of the small intestine nearly all occur in the mesenteric border, while in the colon they are frequently found in the lateral wall or opposite the mesentery in relation to the appendices epiploica.

Age, obesity, constipation, flatulence, general muscular debility, loss of weight, all may be factors in increasing the congenital or acquired weakness and lessening the resistance of the intestinal wall, or increasing the pressure within the intestine and thus causing the intestinal wall to protrude at its weakest point forming the diverticulum. Telling [20] calls attention to the importance of a history of straining at stool as a cause of perforation.

It is difficult to understand, however, why, if constipation is a very important etiological factor, diverticulitis should be more common in men than in women. Also, the patient in the case reported above was a well-developed, muscular man, presenting none of the etiological factors mentioned except flatulence.

Pathology.—Diverticula may be found anywhere in the intestine from the duodenum to the rectum. They are most frequent in the descending colon and sigmoid. While they occur in the rectum, they are rare in this portion of the bowel, due, probably, to its thicker muscular coat (Schreiber [26]). They may be single or multiple, as many as four hundred having been found in a single individual at autopsy. Careful search shows that they are comparatively frequent as, according to Mayo,[9] they may be found by careful search in one-third of the autopsies of middle-aged or older persons.

In the beginning they are small in size and are probably nearly all of the true type; that is, including all of the coats of the intestine. As they increase in size from pressure from within, the muscular coat becomes thinned out and becomes deficient, the circular layer giving way first, and there is often an atrophy of the mucosa with a hypertrophy of the submucosa. While they usually do not attain a large size, they may develop to the size of an egg.

Fæces may be forced into the diverticulum resulting in the formation of a concretion. When this happens ulceration of the mucous layer may occur, or even without ulceration of the mucous layer or concretion formation, there occur inflammatory changes in the wall and surrounding tissues, resulting in a peridiverticulitis. This condition may continue to exist as a subacute or chronic condition, with a resulting thickening and inflammation of the intestinal wall, or perforation may occur with the development of a localized abscess, a general peritonitis or the formation of a fistula. Perforation into the bladder has occurred. Cripps[27] states that the majority of cases of fistula between the bladder and large intestine are inflammatory and not malignant. It has also been shown that carcinoma is apt to develop at the site of the diverticulum. Mayo found that carcinoma had developed in seven out of twenty-seven cases of diverticulitis of the large intestine.

Symptoms.—Diverticula of the intestine, in the absence of inflammatory changes in the walls of the diverticula or surrounding tissues, probably cause little or no symptoms. In the presence of inflammatory changes, the symptoms will vary with the pathological conditions present. Telling,[20] in his analysis of the histories of forty-seven cases, found the average age at which symptoms appeared was fifty-five years.

As it is in the large intestine, particularly the sigmoid, that diverticula are most frequent, and that in this portion of the intestine conditions are most favorable to the formation of fecal concretions, it is in the lower left quadrant of the abdomen that symptoms of diverticulitis usually manifest themselves. As Hartwell and Cecil have pointed out, these symptoms often resemble those of an appendicits in the left side, varying with the pathological process in or about the diverticulum, similar to an analogous inflammation in the appendix. Thus we may have:

1. A mild subacute or chronic inflammation, undergoing remissions, causing pain and tenderness in the left lower quadrant at times, sometimes associated with bladder symp-

toms, especially increase of pain on emptying the bladder when adhesions exist between this viscus and the sigmoid. These symptoms may subside or the pathological process may result in:

2. A chronic inflammation causing thickening in the intestinal wall or mesentery, which may form a palpable mass and be mistaken for a carcinoma, or adhesions to other loops of intestine resulting in signs of intestinal obstruction due to these adhesions, or to narrowing of the calibre of the intestine involved.

3. Acute inflammation, or perforation due to ulceration of the wall of the diverticulum, resulting in a general peritonitis or localized abscess with symptoms on the left side, similar to those caused by an acute inflammation of the appendix.

4. Perforation of a localized abscess into the bladder, or externally on the left side with the formation of a fecal fistula.

5. Development of carcinoma at the site of the diverticulitis.

In addition to the symptoms caused by the above-mentioned conditions, cases have been reported of perforation into a hernial sac, the formation of a loose body or fecal concretion free in the abdominal cavity, and the development of a metastatic abscess in the liver.

Differential diagnosis must be made from carcinoma, tuberculous peritonitis, constriction of the intestine due to other causes, and in the presence of perforation, from other causes of peritonitis. In the presence of a palpable mass, the absence of symptoms of ulceration and melena will aid in the differential diagnosis from carcinoma.

Treatment.—Probably no diagnosis of diverticulitis will be made until an inflammatory process begins in or about the diverticulum. In the presence of perforation the treatment is essentially surgical. If the diverticulum is single and the inflammatory area is localized, a local excision with closure of the opening left by the excision may be practised. If

there is considerable inflammatory thickening of the intestine, or a thrombosis of the mesentery, or an abscess in the mesenteric wall resulting in impaired circulation of the intestine, a resection should be performed. If a localized abscess is present, it is probably better to drain this, with subsequent repair of the fecal fistula, if such develops.

In case it is necessary to do a resection, in the presence of obstruction, where possible the three-stage operation of Mikulicz should be done, or the anastomosis after the method of Bloodgood. When no obstruction is present, and the area resected is high in the sigmoid, a lateral anastomosis should be most satisfactory; while if low down, the anastomosis by invagination of the upper into the lower segment should be the best method.

Although one of the less common abdominal pathological lesions, in making a diagnosis of an abnormal condition in the left lower quadrant of the abdomen, the possibility of the presence of a diverticulitis must be considered. Also, in searching for the cause of a local abdominal abscess or general peritonitis of obscure origin, particularly if no lesion of the appendix is present and the pus has the characteristic odor of the colon bacillus, a perforated diverticulum should be thought of as a possible etiological factor. It is also to be remembered that rough handling of the colon in the course of an abdominal operation for some condition other than diverticulitis, has resulted in the perforation of a diverticulum causing a general peritonitis with fatal result.

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THE HERNIAL SAC IN ITS RELATION TO CONCEALED INTESTINAL INJURIES.

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CONCEALED or subcutaneous injuries of the intestine, exhibiting lesions of more or less severity yet unassociated with a visible destruction of the intervening structures, while not frequent, nevertheless are far from unknown. Barring the minority of such accidents, based upon the dislodgement of and injury to the mesentery and its blood-vessels, leading to secondary dissolution of the intestinal wall, the greater portion of such cases is due to the sudden application of excessive pressure to the muscular walls of the abdomen, which in turn transmit this force to the underlying structures and thence to the opposite wall.

However, we are occasionally confronted with the picture of concealed intestinal injuries, where pressure, in lieu of being applied to the abdominal walls, has been exerted upon the tissues overlying an inguinal hernia.

There are factors, both as regards the relation of intestine to abdominal walls and to hernial sac and as regards the intestinal condition *per se*, which have a definite bearing, not only on the final outcome of the applied pressure, but also upon the methods by which this force may be applied.

Weakening of the intestinal walls, not only by disease but also by circulatory interference due to mesenteric trauma, is especially important in determining rupture, while intestinal distention, with which we are more frequently confronted, is a factor no less important. Probably the abnormal intestinal conditions are of greater frequency in injuries of herniated bowel, owing to the greater possibilities for interference with the vessels supplying intestine so located.

To a certain extent similar in their relation to the en-

veloped intestine, yet the abdomen and sac display anatomical and physical peculiarities quite different from one another, in so far as the reception and defence of pressure is concerned. The former is in part protected by a skeletal wall and in part by muscles fully capable of protecting the underlying intestine from ordinary pressure. The sac, which may be considered as a pyriform prolongation of the peritoneal cavity, consists of a neck or upper portion and a body. The former, generally speaking, is hemmed in by integument and a sparse muscular and aponeurotic covering and the pubic ramus. The body is enveloped on all sides by the elastic scrotal wall, and hence but poorly protected.

The methods by which pressure is applied varies. Crushing accidents, blows, horse kicks, falls, are responsible for the majority of concealed intra-abdominal intestinal injuries, while to these may be added, in the case of intrasaccal injuries, manual trauma, a product of the pernicious habit of the forcible reduction of herniæ.

The direct cause of such injuries has been a fruitful source of discussion, and generally speaking one must bear in mind the difference in the resisting power of the various walls—of the skeletal and muscular walls of the abdomen—of the muscular and integumental coverings of the sac, and of the skeletal bridge which underlies it.

Depending upon its direction and application, abdominal pressure may either be broken on the skeleton, may force muscular wall to rigid skeleton, or may approximate muscular wall to muscular wall. In the former case it is extremely unlikely that, without external evidences of injury or fracture, harm could be done the intestines or mesentery to any great degree. What changes occur when muscular wall is forced against the vertebral column, or the sacral promontory, or other points of the bony framework? The abdominal cavity is directly encroached upon and the intra-abdominal pressure greatly increased, due to the marked diminution of the size of its cavity; while the intestines, in great part, are driven from the immediate region of the greatest extra-

abdominal pressure into areas free from this force, where they are temporarily fixed. The extra-intestinal pressure is focussed upon those sections "caught" between the opposing walls. The intra-intestinal pressure is greatly increased, not only in those imprisoned sections but also in the sections immediately adjoining these, as the gas and fluid are rapidly displaced from the former into the latter.

The action of the diaphragm in relieving intra-abdominal pressure as it is driven upward is neutralized, to all intents and purposes, by the reflex contraction of the other muscular boundaries of the abdomen. While the increased abdominal pressure is hardly in itself responsible for direct intestinal injury yet, by fixing the intestines, it is probable that the latter are more susceptible to synchronous blows with different points of application, and also to the injuries sometimes ascribed to muscular action alone, and to the possibility of the extrusion of a part of the tense wall, distended with gas and fluid, through the neck of a hernial sac.

The local increase in extra-intestinal pressure focussed upon bowel imprisoned between opposing walls is no doubt the greatest single factor in concealed intestinal injuries. The bowel wall, delicate as compared with the parietes, is ground, bruised, torn, and crushed against the bony skeleton, while the abdominal wall shows little or no evidences of the pressure.

Finally, the increased intra-intestinal pressure, due to the expressing of gas and fluid rapidly from one section of bowel to another, is occasionally the cause of an "explosive" rupture, when the increase in intra-intestinal pressure overcomes the resistance of the intestinal wall.

When muscular wall is forced against muscular wall there is no doubt but that the intra-abdominal conditions are altered very much, but there is great doubt whether only a rare case will show rupture or injured intestines under these conditions, so greatly is the shock ameliorated by the elasticity of the opposing muscular wall which acts as a buffer to the blow.

Similar principles may be applied under different conditions to the hernia sac and its contents. In its upper part, with its rigid background of pubic ramus and its thin unprotecting covering, conditions are ideal for a crushing injury, such as truss injuries, kicks, blows, etc. Unlike this the lower portion has no bony border, but is completely enveloped in thin elastic scrotal wall and yields readily to pressure; and the lack of support affords heightened susceptibility to explosive and crushing ruptures, to direct injuries, and to manipulative trauma, the latter so frequently associated in this location with bowel whose resistance has been lowered by constriction.

The fixation of the scrotum, the distention and amount of bowel in the sac, its condition and fixation, and the elasticity of the scrotum—all are important determining factors in such injuries and involve definite physical principles which make it possible to explain the outcome of the pressure.

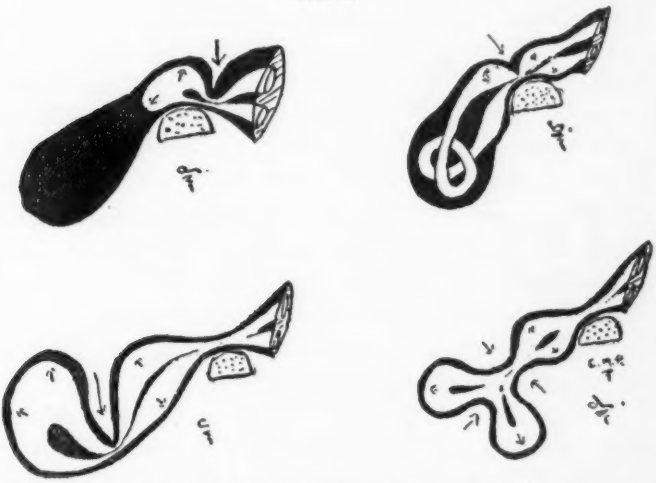
The following cases which have been operated on by the writer for this condition are interesting in that they represent nearly all the different forms of concealed intestinal injuries with which one meets in the hernial sac.

Case I.—S. M. W., aged 27. Right inguinal hernia "caught down" 24 hours before admission. *Forcible reduction applied.* Condition persistently became worse. Is restless, toxic, shocked. Pulse 120, temperature 99.2°, white blood-cells 35,000. Abdomen: Marked distention. C. M. obliterated. R. M. everywhere limited. No visible peristalsis. No masses seen. Distinct bulging in flanks. Slight general tenderness of entire abdomen, but walls fairly soft. Tympany everywhere except in right flank, where there is slight movable dulness. Liver dulness 4 cm. above C. M. In right inguinal region there is a bulging which reaches from internal ring into scrotum, forming an oval swelling about 6 × 4 cm. Percussion note flat. Fairly soft. Skin movable over swelling. Slightly tender. Rectal examination: Marked bulging in anterior wall. Testes and epididymes normal.

Operation (Dr. Remsen): Under cocaine, skin and external oblique aponeurosis divided; the ilioinguinal and iliohypogastric

nerves blocked and divided and a congenital sac filled with bloody fluid and strangulated omentum found. Digital examination revealed, higher up, what appeared to be a hernia reduced *en masse*. Abdominal exploration revealed the following: omentum and small intestine running through internal ring and into hernial sac, the "ring" having been displaced inward so that the swollen omentum had completely hidden the bowel in the sac. Divulsion of the ring and excision of the omentum allowed reduction of the bowel into the protected general cavity. The wall everywhere

FIG. 1.



Hernial sacs seen in cross section representing, schematically, intestinal compression and dilatation due to pressure applied above the ramus (Case IV); over the ramus (Case V); to the scrotum (Case II); and manipulative pressure applied to the scrotum (Cases I and III).

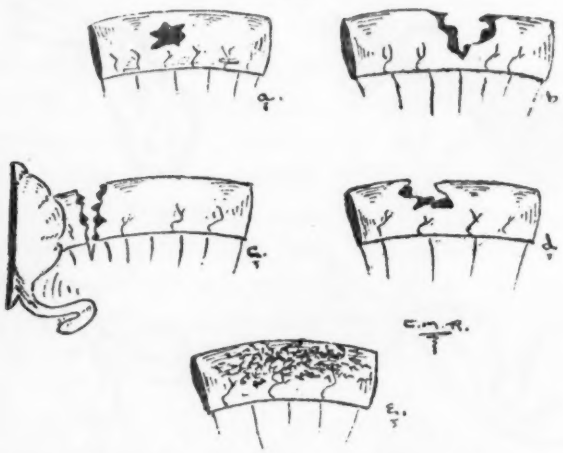
was in good condition even where compressed by the ring except for two ruptures, one completely through the circumference of the wall (Fig. 2, *c*) the other partially through (Fig. 2, *d*). General condition called for a quick enterostomy and tubes were inserted into both openings. A partial operation for hernia was performed quickly. Patient never rallied. Death in 24 hours.

CASE II.—J. L., aged forty-seven. Seven hours previous, while running for a street car, patient *tripped and fell, striking a rather large inguinal hernia upon a cobble stone.* Intense abdominal pain, nausea, and vomiting followed. Patient restless at examination. Pulse strong, slow, regular. Abdomen scaphoid; entire absence of respiratory movements; C. M. well marked; no

distention. No masses nor visible peristalsis. General tenderness not localized. An extreme degree of abdominal rigidity existed. Submural palpation impossible. There is a small swelling in the inguinal region, tympanitic, very soft, compressible and tender and increased in size on coughing.

Operation (Dr. Remsen): Inguinal swelling explored first. A hernial sac filled with fecal matter and containing no bowel was exposed. Fecal material was seen escaping from abdominal cavity through inguinal canal into sac. Immediate abdominal exploration revealed a ruptured ileum (Fig. 2, *a*) and a peritoneal

FIG. 2.



Concealed intestinal injuries occurring in the hernial sacs (viz. text).

cavity soiled with intestinal contents. Suture of rupture and careful toilet of the peritoneal cavity and slight drainage completed the abdominal operation. Sac treated by drainage owing to soiling with the intestinal contents. Recovery with only slight recurrence of hernia.

CASE III.—M. B., aged twenty-two. Hernia two years. "Caught down" 48 hours before admission, with nausea and vomiting. *Forced manipulative reduction* 36 hours ago with disappearance of the mass and cessation of vomiting but with increase in pain which now extended to abdomen. Pulse slow and soft. White blood-cells 22,000. Pupils small. (Patient has been given large amounts of morphia.) Face anxious. Patient thirsty. Abdomen markedly distended. Moderately tender over

lower portion. Respiratory movements diminished. No elevation of liver dulness. No shifting dulness. Large patent external (right) abdominal ring. No bowel in sac. Bowels moved once since onset. Owing to the masking of symptoms by morphia it seemed advisable to explore immediately.

Operation: Abdominal section revealed a section of bowel about 50 cm. in length limited by two indented circumferential impressions due to the pressure of the ring. In one portion of this section of bowel there was a definite bruising and reddening not at all resembling the bowel seen in a strangulated hernia (Fig. 2, *e*). This was viable, and active peristalsis occurred after artificial stimulus. The abdomen was closed and radical cure of the hernia followed. Recovery.

CASE IV.—I. M., aged forty-nine. Fall from scaffold four hours previous, *striking his abdomen (left inguinal region) across projecting board.* At present lies on back moaning with pain, thighs flexed, cautious respiratory movements. Markedly shocked. Very large left inguinal hernia exists. Palpation reveals intense abdominal rigidity. Submural palpation impossible. Abdominal tenderness general. Hernial sac very tender, and even gentle manipulative measures cause great pain. Liver dulness at six R. No shifting dulness. Increased abdominal tenderness in L. I. F. Slight general distention of abdomen. Marked shock. Blood-pressure 65.

Operation: Left rectus incision. On opening peritoneal cavity there was an escape of gas and bloody fluid. Search revealed a ruptured ileum (Fig. 2, *b*) in close proximity to the internal ring (left) and some intestinal contents extruding from sac into abdominal cavity through the ring. Very small amount of intestinal contents seen in the abdominal cavity itself. From these findings it seemed that the rupture had occurred in the sac itself rather than in bowel that was in the abdominal cavity at the time of the accident. Resection and lateral anastomosis. Patient never rallied. Death in two hours.

CASE V.—C. M., aged twenty-seven. Left inguinal hernia "caught down" several years ago and reduced successfully. Has been wearing truss for some time. Thirty-six hours ago *patient fell and compressed truss against pubic ramus, the hernia having been extruded during the fall.* Following this patient had severe abdominal pain, which, however, has diminished in the last 12

hours. Nausea but no vomiting. Abdomen now shows slightly diminished respiratory movements on left side. General condition normal. There is slight tenderness in left iliac fossa, well localized and corresponding to the area of abdominal tenderness. Hernial sac negative. General condition excellent and the local signs so mild and showing improvement so markedly that operation was postponed. Local conditions improved and patient discharged in three days with no abnormal symptoms.

Suggestive, then, is the history of trauma applied to a hernial sac, followed by acute abdominal signs and symptoms; the tense rigidity of the abdominal walls, as emphasized by Moynihan, in concealed abdominal ruptures; and the soft, tender, fluctuant and bulging hernial sac, an evidence of the escape of intestinal contents into this latter cavity. When coupled with the shock and general symptoms and signs which one would expect with such an injury, there is formed a group almost positively indicating a concealed injury or rupture of bowel contained, at least at the time of the accident, in the sac which has suffered the trauma.

I wish to acknowledge my thanks to Dr. William S. Halsted for his kindness in allowing me to report the four cases of this series that occurred while I was in his service at the Johns Hopkins Hospital.

ON THE DEVELOPMENT OF MALIGNANT DISEASE OF THE CERVICAL STUMP AFTER SUPRAVAGINAL HYSTERECTOMY.

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A PATIENT who, eighteen years ago, had had a supravaginal hysterectomy for an advanced pelvic inflammatory disease, recently presented herself a second time for treatment at the clinic. Examination revealed a moderately advanced carcinoma of the cervical stump. On looking over the records of the clinic, one other similar case was found. At Dr. Kelly's suggestion, I have prepared a brief report of these two cases with a review of the literature on the subject.

M. Q., a negress, aged forty-three, entered the hospital for the first time in December, 1894, suffering with a severe pelvic inflammatory disease. At operation, the omentum and sigmoid were found densely adherent to a tubo-ovarian abscess on the left side. The adhesions were released and uterus removed by supravaginal amputation together with the adnexa on each side. The patient made a rapid and uneventful convalescence. About six weeks ago, some eighteen years after her operation, she returned complaining of profuse vaginal bleeding. This had begun one month previously with a sharp hemorrhage which lasted four days. Two weeks later, the bleeding reappeared and had continued up to the time of admission to the hospital. At operation, Dr. T. S. Cullen had the patient first placed in the lithotomy position, when the cervix was carefully examined. The posterior lip of the cervix was found to be the seat of a roughened, friable growth which bled very readily on manipulation and which apparently had not extended beyond the cervical stump. There being no doubt of its malignant nature, the

abdomen was opened through a generous mid-line incision, and the cervix removed by Wertheim's method. Considerable difficulty was experienced during the operation on account of the dense adhesions about the cervical stump, the bladder and ureters. The cervix, together with the growth and a wide margin of normal vaginal wall, was successfully removed, however, without injury to the ureters. Aside from slight suppuration at the lower angle of the incision, the patient made an uninterrupted recovery. Microscopic examination of the growth showed it to be squamous-cell carcinoma.

The second case, E. L., age thirty-eight, was first admitted to the hospital in January, 1900, complaining of an abdominal tumor. Examination showed the lower abdomen to be distended asymmetrically by a large cystic mass more prominent on the left side. At operation, Dr. Kelly found a large ovarian cyst on the left side and a somewhat smaller one on the right, both densely adherent to the uterus, bladder, omentum and intestines. After much difficulty, the adhesions were finally released sufficiently to allow the removal of both cysts together with the tubes and uterus, the latter being amputated at about the level of the internal os. The raw areas were then closed over as far as possible. The patient made a satisfactory recovery and was discharged well some three weeks later. She remained in excellent health until November, 1903, when she began to have a foul vaginal discharge. She was again admitted to the hospital, in July, 1904, having had two severe hemorrhages from the vagina, each of which had followed a vaginal examination by her physician at home. On admission, a fungating growth was found which occupied the entire cervix and the vagina for a short distance about it, and the entire anterior vaginal wall down to a point below the internal urethral orifice. In spite of the extensive vaginal involvement the growth seemed quite freely movable. At operation, Dr. Sampson found the pelvis filled with adherent loops of intestine and omentum. With much difficulty, these were freed and the cervix found, when it could be seen where the growth had extended upward. The ureters on each side were then freed and the cervix dissected loose laterally. Incision was then made into the bladder, the outer wall of which, together with the growth, was excised down to

the internal urethral orifice. The entire growth was apparently removed with a large margin. On the seventh day the patient became very restless and a condition of anuria set in. After infusions of saline, the patient improved and towards evening, the temperature, which had risen to 104°, fell to normal. Her condition then improved steadily until the twelfth day when there again appeared high fever, nausea, vomiting and anuria. On the following day, the condition had improved slightly but on the fourteenth day there was again complete renal suppression with pain in the region of the left kidney. Under nitrous oxide anæsthesia, Dr. Sampson exposed the left kidney and a number of small abscesses were found scattered over the cortex. These were incised with the Paquelin cautery after stripping back the capsule. On the fifteenth day, the patient's condition was unimproved and on the sixteenth day she died. Microscopic examination of the growth removed at operation showed it to be a squamous-cell carcinoma.

Chrobak [1] was probably the first to call attention to the possibility of the development of a malignant growth in the cervical stump after supravaginal hysterectomy. He reported three such cases, in two of which carcinoma was found and in the other, sarcoma. A number of similar cases have since appeared in the literature from time to time, Botzong,[2] in 1902, being able to collect quite a large list. So many cases have been reported since the appearance of Botzong's monograph that it seems worth while to review again the entire literature, particularly as the number of cases now at hand is large enough to justify conclusions as to their real clinical significance.

In the following table, there is reviewed a list of all the cases which have been more or less completely reported up to the present, while following it, is a list of the cases which have been occasionally mentioned in the literature, but never completely reported.

Author*	Supravaginal Hysterectomy for	Type of Malignancy in Cervical Stump	Subsequent Development	Remarks
Botzong [3]	Myomata uteri	Carcinoma	4 years.	
Chaput [4]	*a* Pelvic inflammation	Carcinoma	1 year 3 mos.	
	b Pelvic inflammation	Carcinoma	1 year.	Possibly coexisting.
	c Pelvic inflammation	Carcinoma	6 years.	
	d Pelvic inflammation	Carcinoma	2 years 6 mos.	
Chrobak [1]	*a* Myomata uteri	Carcinoma		
	b Myomata uteri	Carcinoma		
	c Myomata uteri	Sarcoma		
Currier [4]	Myomata uteri	Carcinoma	8 mos.	Probably coexisting.
		Carcinoma		
Fleischmann [5]	Myomata uteri	Carcinoma	7 years.	
Freund [6]	Menorrhagia	Carcinoma	1 year 6 mos.	Probably coexisting.
Hargrave [7]	Myomata uteri	Carcinoma	6 mos.	Probably coexisting.
Jacobs [8]	*a* Myomata uteri	Carcinoma	1 month.	Almost surely coexisting.
	b Myomata uteri	Carcinoma	1 month.	Almost surely coexisting.
Kaufmann [9]	Myomata uteri	Carcinoma	4 years.	Found at autopsy.
Ladinsky [10]	Myomata uteri	Carcinoma	6 mos.	Probably coexisting.
Leonard	*a* Pelvic inflammation	Carcinoma	18 years.	
	b Bilateral ovarian cysts and pelvic inflammation	Carcinoma	3 years.	
Lewis [11]	Myomata uteri	Carcinoma	6 mos.	Probably coexisting.
Lumpe [12]	Pelvic inflammation	Carcinoma	1 year 8 mos.	
Manton [13]	Myomata uteri	Sarcoma	3 mos.	Probably coexisting.
Menge [14]	Myomata uteri	Sarcoma	9 mos.	Sarcoma later found in original specimen.
Newman [15]	Myomata uteri	Carcinoma	7 years.	
Noble [16]	Myomata uteri	Carcinoma	8 mos.	Probably coexisting.
Norris [17]	Myomata uteri	Carcinoma	2 years.	
Olshausen [2]	*a* Myomata uteri	Carcinoma	7 years.	
	b ?	Carcinoma	7 years.	
Quenu [18]	Myomata uteri	Carcinoma	5 years.	
Richelot [20]	Myomata uteri	Carcinoma	6 mos.	Probably coexisting.
	Myomata uteri	Carcinoma	?	
	Myomata uteri	Carcinoma	3 years.	
Savor [21]	Myomata uteri	Carcinoma	4 years.	
Schenk [22]	"Large uterine tumor"	Carcinoma	5 mos.	Probably coexisting.
Turner [23]	Myomata uteri	Carcinoma	8 mos.	Probably coexisting.
v. Ehrlach [24]	Myomata uteri	Carcinoma	1 year.	Probably coexisting.
Wehmer	Myomata uteri	Sarcoma	8 mos.	Probably coexisting.

*Figures after authors refer to bibliography.

In addition to the cases listed in the preceding table, Richelot,[20] speaks of Hartman [26] and Murtry,[27] each having seen one case, LeDentu, two cases and Péan [29] "many more." Christopher Martin [30] is reported to have seen seven instances of malignant disease in the cervical stump after supravaginal hysterectomy, developing from a few months to several years after operation. Ladinski [10] states that he has seen three cases in the addition to the one noted in the table. Savor [21] speaks of a case seen by von Hacker [31] and Olshausen [18] refers to one noted by Pawlik.[32] Batigne,[33] Condamin,[34] Krusen and Hammond [35] have also reported cases but I have been unable to secure their references. In the table, there are thirty-six cases, while about twenty more have been casually mentioned in the literature, making a total of somewhat less than sixty cases reported up to the present time.

The fact that carcinoma has occasionally developed in the cervical stump after a supravaginal hysterectomy has often been used as an argument in favor of panhysterectomy whenever circumstances demand the removal of the uterus, and indeed a number of surgeons have abandoned the subtotal operation on this account alone. When one considers that of the many thousands of supravaginal hysterectomies performed this complication, serious as it is, has been reported in less than sixty cases, it would seem that the abandonment of the operation on this account, for panhysterectomy with its higher primary mortality and familiar disadvantages, is unjustified. Botzong [2] in 724 cases of supravaginal hysterectomy, collected from representative European clinics, reports a primary mortality of 2.61 per cent., while in 499 cases of panhysterectomy the mortality proved to be 6.6 per cent. The occasional case of carcinoma developing in the cervical stump after supravaginal hysterectomy, even if considered as a life lost and added to the mortality statistics of that operation, would not materially alter Botzong's figures; panhysterectomy would still have a primary mortality more than twice as great. In other words, those operators who have abandoned subtotal hysterectomy for panhysterectomy through fear of sub-

sequent malignant degeneration in the cervical stump are probably sacrificing several lives to save one. Furthermore, the development of carcinoma in the vaginal vault after panhysterectomy for non-malignant disease, is not unknown; Delbet [36] and Quenu [19] have each reported such an occurrence, the latter author having observed two examples. The comparative rarity of carcinoma of the cervix after supravaginal hysterectomy is probably correctly explained by Faure [37] who in over a thousand cases of subtotal hysterectomy has never observed malignancy in the cervical stump. He says, "I have often examined the cervix after supravaginal hysterectomy; it is almost always small, atrophied, and I am convinced, in a state of epithelial inactivity decidedly unfavorable to the development of cancer." Even among the comparatively few cases reported, a number must be thrown out on the grounds that cancer of the cervix existed at the time of the hysterectomy but escaped detection. Among the thirty-six cases in the table there are at least sixteen, in which it is very improbable that the development of the cancer was truly subsequent. If these cases be dropped, the list is practically cut in half, giving even a better appreciation of the infrequency of the condition.

In the great majority of cases of carcinoma developing in the cervical stump after supravaginal hysterectomy, the uterus had been removed for myomata. A glance at the table is sufficient to convince one of this fact. There are 36 cases in the table, in 26 of which, or 72 per cent., the uterus had been removed for myomata. If we consider only those cases in which the carcinoma which subsequently developed was, in all probability, non-existent at the time of operation, we find that in 63 per cent. the uterus had been removed for myomata. It would seem, then, that the question of "Stumpfkarzinom" resolves itself into a consideration of the etiological relationship of myomata to cancer and a consideration of the technic to be used in removing a uterus containing myomata and not the technic of hysterectomy in general. The cases in which malignancy has developed in the cervical stump after

removal of the uterus for pathological conditions other than myomata, are so few compared to the many thousands of supravaginal hysterectomies for these conditions as to be practically negligible. Their percentage of frequency would certainly not exceed and probably not equal that of carcinoma of the cervix in any group of women. As Winter[38] has said, the question of carcinoma of the cervical stump is so intimately associated with the consideration of the combination of myomata and cancer that a discussion of one is incomplete without due notice of the other.

Of late years, a rather extensive literature has accumulated indicating the frequency of cancer of the uterus associated with myomata. Dr. Noble,[16] in discussing Currier's paper at the meeting of the American Gynæcological Society in 1906, drew attention to the fact that the evidence at hand, that the presence of fibroid tumors of the uterus led to cancer, was overwhelming, and in the same year reported 8 per cent. of cancer in his last hundred cases of myomata of the uterus. Winter[38] has published some statistics very interesting in this connection. To his lists below, I have added the figures reported by Dr. Noble and Dr. Cullen.[39]

FREQUENCY OF CANCER OF THE UTERUS WITH MYOMATA.

Hofmeier	445 cases of myomata uteri..	17 cases
Winter	753 cases of myomata uteri..	23 cases
Noble	1188 cases of myomata uteri..	41 cases
Cullen	1400 cases of myomata uteri..	43 cases
Total	3786 cases of myomata uteri..	124 cases

Of 3786 cases of myomata of the uterus 124 cases, or *slightly over three per cent.*, showed cancer of either the body or cervix. No reliable statistics of the absolute frequency of cancer of the uterus exist, but to place it at three per cent. would be absurd. The assertion that myomata exert an influence favorable to the development of cancer of the uterus is therefore incontestable. This influence is even more clearly demonstrated when we compare the relative frequency of cancer of cervix and body of the uterus, when these conditions

exist alone, to their relative frequency when associated with myomata. Of 2513 cases of cancer of the uterus reported by Hofmeier, Krukenberg, Freundsen, Küstner, Winter and Cullen, 186 cases, or 7.4 per cent., were carcinoma of the body. On the other hand, of 215 cases of cancer of the uterus, in association with myomata, reported by Hofmeier, Martin, Geuer, Winter (Berlin), Winter (Königsberg), Noble and Cullen—134 cases or 62.3 per cent., were cancer of the body. This remarkable contrast of the relative frequency of carcinoma of the body of the uterus, alone and in association with myomata, can only be explained by the assumption that fibroids bear a definite etiological relationship to cancer of the body of the uterus.

The question now arises as to whether the cervix, in a measure, also shares the tendency to become cancerous in the presence of myomata. Is the absolute incidence of carcinoma of the cervix increased when associated with fibroids of the body of the uterus? The question is answered in the affirmative by Winter,[38] who reports 25 cases of cancer of the cervix occurring among 1270 cases of uterine fibroids; about *two per cent.* He says in this connection, "There can not be the slightest doubt that even in those regions where carcinoma is most abundant an absolute frequency of carcinoma of the cervix of two per cent. is not in the remotest degree attainable." Again, Richelot[20] has pointed out that the general hypertrophy of the endometrium accompanying myomata of the body of the uterus is shared by the cervical epithelium; so that if this tendency to carcinomatous degeneration be directly attributable to active epithelial proliferation on the part of the uterine mucosa, there is sufficient ground for the assumption that the incidence of carcinoma of the cervix would likewise be increased. The fact that nearly three-fourths of the cases of carcinoma of the cervix, following supravaginal hysterectomy, thus far reported, have occurred after removal of the uterus for myomata, is strong presumptive evidence of some definite etiological association of the two conditions.

In a number of cases operated on for uterine fibroids an early carcinoma of the cervix has been discovered more or less by accident. Landau[40] and Küstner,[41] according to Winter, have each had such an experience. Landau, while doing an abdominal myomectomy, discovered a small carcinomatous plaque in the depths of the cervix. Küstner found an early carcinoma of the cervix at autopsy in a woman who had died after a supravaginal hysterectomy for fibroids. Dr. Cullen[39] reports a case of great interest in this connection: Vaginal hysterectomy was performed, an interstitial myoma 3 x 3 x 2 cm. being found in the uterus. In the course of the routine laboratory examination of this specimen, there was found the earliest squamous-cell carcinoma of the cervix he had ever seen. In speaking of this case, Dr. Cullen says: "Had an abdominal supravaginal hysterectomy been done instead of total vaginal hysterectomy, we would ere long have had a well marked carcinoma of the cervix, and would have classed it as a carcinoma developing in the cervix after removal of the myomatous uterus, whereas the growth though clearly present at the time of operation, would have been overlooked." There can be no doubt, that in many, perhaps in half, of the cases listed in the table above, the carcinoma, though reported as having developed subsequently, was in reality present at the time of operation.

It is to such cases as those reported by Landau, Küstner and Cullen that attention should be drawn, as they clearly indicate the necessity for great watchfulness on the part of the operator, when dealing with uterine fibroids. Landau's case is particularly instructive as it would seem to suggest a procedure which if carried out as a routine in performing supravaginal hysterectomy for fibroids, would occasionally reward the operator by the discovery of an unsuspected carcinoma of the cervix. For a number of years Dr. Kelly[42] has made a practice of "cupping out" the cervix after supravaginal amputation of the uterus so that a better closure of its sectioned surface may be effected. Of this procedure, he says: "It is occasionally of considerable advantage to cup

out the cervix, dissecting out its mucous canal deep down toward, or into, the vagina. This step in the technic, involving a thorough enucleation, has recently been elevated to the dignity of a method by the distinguished London surgeon, Bland Sutton." The technic is simple, and adds but a moment to the operating time, which is largely compensated by the ease with which the cervix may be afterwards closed over. Should this procedure be employed as a routine in performing supravaginal hysterectomy for fibroids, the advantages would seem to be considerable: (1) The cervix could be more easily closed over. (2) A carcinomatous focus deep in the cervix, which would be otherwise overlooked, would be brought to light as in Landau's case. (3) By the removal of a large amount of the glandular portion of the cervix, the chances of subsequent carcinomatous degeneration would be proportionately diminished. It seems almost superfluous to add that, before the abdomen is opened, the cervix should be examined under sight and before closing, the amputated uterus should be laid open and carefully examined for evidences of carcinoma. Bearing in mind that three per cent. of all fibroids of the uterus are associated with cancer, a strict observance of these precautions would seem not only justifiable but of considerable importance.

To Dr. Howard A. Kelly, I wish to extend my thanks for suggesting the subject of this paper and for permission to report the two cases noted, which occurred in his clinic at the Johns Hopkins Hospital.

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SACROCOCCYGEAL TUMORS.

WITH A REPORT OF A LARGE TERATOMA.

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THE tumors of the sacrococcygeal region provide the most interesting and complicated collection of developmental errors of any region of the human body, so that before recording the details of a case which came under my care early this year it will perhaps help to make clearer its pathogenesis if the account is prefaced by a few words regarding the development of the caudal end of the embryo. Apart from neoplasms, such as lipomata, angiosarcomata, and lymphangiomata, which have no characters peculiar to this region, and leaving aside spinal defects, anterior and posterior spina bifida, spina bifida occulta, and the congenital dorsisacral herniæ, the congenital tumors of the sacrococcygeal region may be classified best into four chief groups: (1) caudal appendages; (2) dermoid cysts; (3) mixed tumors; (4) fetal inclusions.

1. *Caudal Appendages.*—These are of two types: true tails and pseudotails. The former consist of new growth of cartilage and bone or are definite prolongations of the sacrum.[1] The false tails are due to persistence of the caudal filament, or may be caused by the presence of a tail-shaped lipoma. False tails contain no bone.

2. *Dermoid Cysts.*—These may exist as sinuses or as simple dermoid cysts, and frequently contain collections of hair. They are found in the middle line of the body at the lower end of the sacrum and coccyx between the buttocks. Irritation and inflammation in adult life may be the cause of their being noticed at that time, although they have been present since birth. Their presence has been accounted for by various theories: incomplete closure of the medullary

canal,[2] a dimple of the skin bound down to the coccyx,[3] etc.

3. *Mixed Sacrococcygeal Tumors.*—These growths present an extremely complex structure and have been found to contain the following elements:[4] cysts of varying size lined by simple or stratified epithelium, polymorphous and sometimes ciliated; glandular epithelial collections; bone and cartilage; striped and smooth muscle; nerve tissue; fat, etc., all mixed together in a conglomerate mass in a connective-tissue framework (Figs. 4 to 8).

Von Bergmann, Braune and Lotzbeck consider that these tumors are monogerminal—arising from the hyperplasia of a group of organs belonging to the subjects to which they are attached.

The various transitory organs appear to be able to give rise to the neoplasms, each to that portion which concerns it. The transitory structures in question are: (*a*) caudal medullary tube; (*b*) primitive streak and neurenteric canal (Von Spee and Hildebrand); (*c*) postanal gut (His); (*d*) chorda dorsalis; (*e*) coccygeal gland. Förster, Virchow, Bonnet, and others consider these tumors to be, on the other hand, of bigerminal origin and so to represent a second individual in a more or less rudimentary condition.

4. *Fetal Inclusions.*—When the bigerminal formation is complete we have the double formation—for example, the Siamese twins. When incomplete, as is more usual, an arm, a leg, or a foot is attached to the sacrum and part is included under the skin.

My own case, which I now wish to report in some detail, belongs to the third group; it is a monogerminal mixed tumor and is of the cystic type.

The cystic mixed tumors are by far the most commonly found class. The size is variable; it may be from the size of an orange to that of a child's head—it rarely exceeds the latter size. The tumor may not grow at all after birth or may grow slowly. Rectum, bladder, and genitals may be much displaced and their functions interfered with, particularly if the tumor projects forward toward the perineum as it did in

my case. The surface of the tumor is smooth and regular over the larger cysts in contrast to the more nodular surface over the smaller cysts and solid portion. The swelling is soft, fluctuant, and translucent.

REPORT OF CASE.

A female infant, four days old, was sent to me, at the Manchester Northern Hospital, by Dr. Kyle, of Oldham. It was the fifth child of the family; the parents did not know of a deformity of any sort among their relatives, immediate or remote. Apropos of the bigerminal theory in relation to this class of tumors, it was ascertained that the only history of plural birth in the family was the case of the infant's paternal grandmother, who was herself a twin. Previous to the child's birth the mother said she could feel, on careful abdominal palpation, what she took to be two fetal heads, and when the child was born a swelling almost as big as its head was found in the perineal region.

It was said to have undergone no change during the four days which elapsed before I saw it, and the tumor, which was then roughly the size of the child's head, was, as the photograph (Fig. 1) shows, projecting from the sacrococcygeal region and apparently separating the glutei muscles of the two sides and chiefly projecting to the left. The tumor also extended forward to the perineum so that the anus was displaced downward and came to open directly forward.

The most prominent and dependent part of the swelling was covered by tense, shiny skin, which obviously enclosed a large collection of fluid. The upper part of the growth close to the coccyx was much firmer in consistency, and felt as though the coccyx, much enlarged, were continued down into the tumor. The general condition of the child was fairly good—on admission there was some diarrhœa (it had been bottle-fed) and the motions were so irritating as to have caused a good deal of soreness round the anus. There was no paralysis nor malformation of the legs. Micturition and defecation were not interfered with. It was found also that pressure over the cyst had no effect on the prominence of the anterior fontanelle. After sterilizing the skin the needle of a large exploring syringe was inserted at the most prominent point of the cyst, and several ounces

FIG. 1

To show ventra aspect, relation of anus etc.

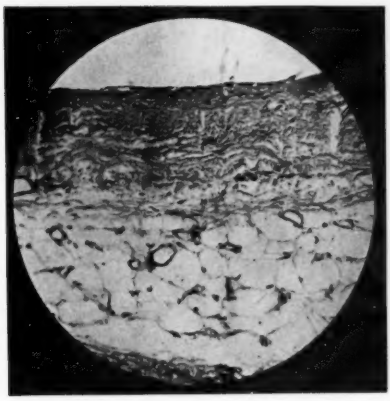
FIG. 2.

Lateral skiagram. Tumor outline dotted.

FIG. 3.

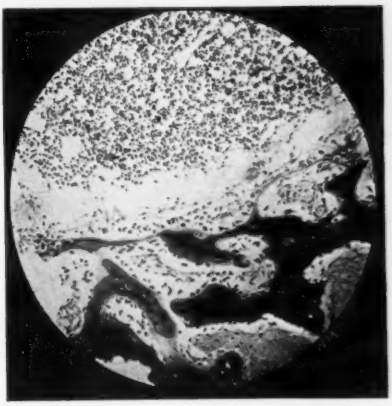
Sacrococcygeal tumor (deep aspect).

FIG. 4.



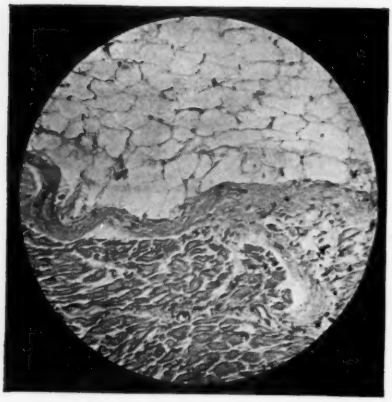
The cyst wall (fibrous) with adipose tissue (× 175 diameter).

FIG. 5.



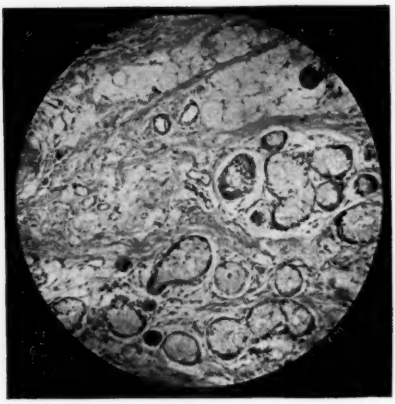
Bone and bone marrow (× 40 diameter).

FIG. 6.



Striped muscle and adipose tissue (×175 diameter).

FIG. 7.



Glandular tissue, probably salivary gland (× 75 diameter).

FIG. 8.

Columnar epithelium, probably rudimentary stomach (× 40 diameter).

of serous fluid were allowed to escape. After this had been done it became apparent that the cystic part of the tumor was multilocular and a second smaller cyst was tapped.

The solid element could now be examined more carefully; it was found to be about one and a half inches long and one inch across. Per rectum it could be felt running down behind the rectal wall commencing at the coccyx which felt much thickened. The fluid collected from the cysts proved to be simply serous and not cerebrospinal.

The diagnosis of sacrococcygeal tumor was made, and it was decided that removal should be attempted. As the operation was obviously to be of a serious nature it was postponed for a few weeks till the child should be in better physical condition. In the interval the skiagram (Fig. 2) was taken.

Operation.—To diminish shock the child was enveloped in a cotton wool suit which left exposed merely the head and the field of operation. Ether anæsthesia. Very little hemorrhage occurred. The growth was separated with little difficulty except where the rectum was in close apposition, and while dissecting in this situation a soft bougie in the rectum was of considerable assistance. The tumor (Fig. 3) after removal proved to be about six inches in length, four and a half inches across, and about the same depth. On the deep attached surface the coccyx ran directly into the solid growth and it was necessary to remove it with the growth.

The child made a surprisingly good and complete recovery; some little ingenuity and very frequent attention were required to ensure clean healing of the extensive and awkwardly situated wound.

The most successful treatment is undoubtedly radical excision as early as possible, so as to diminish the risk of thinning of the cyst wall and subsequent infection.

Palliative means, such as tapping, injection of irritants, etc., have frequently resulted in septic infection and death.

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PURPURA OF THE BLADDER.

REPORT OF A CASE WITH A DESCRIPTION OF THE CYSTOSCOPIC APPEARANCES.

BY FRANK KIDD, F.R.C.S.,
OF LONDON,
Assistant Surgeon to the London Hospital.

REPORT OF A CASE.—Selina H., aged twelve years, was admitted to Sophia Ward, London Hospital, Nov. 30, 1910, with the history that on Nov. 29 at 8 P.M. she felt a sudden desire to pass water and during the act experienced a sharp stabbing pain starting in the left iliac region and spreading into the vulva. Between 8 P.M. and 9.30 P.M. she passed water four times, each time noticing a similar pain which lasted only as long as water was passing and ceased at once at the end of the act. At 9.30 P.M. she passed water again and this time inspected it. It was full of blood. An aching pain came on in the left iliac region when she went to bed and lasted all night and the whole of the next day. Urine was passed once in the night and five times during the next day up till the time of admission into the hospital at 5 P.M. on Nov. 30.

Previous Health and Habits.—Diphtheria five years ago, otherwise no serious illnesses. No hæmophilia. No scurvy. The patient lives in Poplar amidst poor and unhealthy surroundings. She has had a sore throat for some days before the onset of the hæmaturia and has felt "out of sorts."

Examination.—The patient looks ill and is pale and anæmic. The temperature is normal. Pulse and respiration rate normal. Tongue clean and moist. Heart, lungs, and alimentary system normal. There is follicular tonsillitis on the left side and some slight enlargement of the glands on the left side of the neck which are tender to the touch. The skin shows no petechiæ.

The gums are healthy. There is deep tenderness over the bladder region, especially on the left side. The urine is full of blood clots and contains bright red blood diffused throughout. The patient was at once taken into hospital and put to bed. By the next morning the bleeding had disappeared and the pain had ceased.

Further examination elicited the following facts:

1.12.10. X-ray examination of the bladder and kidney areas showed an absence of stone shadows. Urine clear to the naked eye, 38 ounces in 24 hours. Reaction acid, specific gravity 1021, no albumin, urea 2.5 per cent. Hæmorenal index (electrical resistance of urine and serum) 1.5 (normal 2).

2.12.10. Cystoscopy. The bladder was filled with 8 ounces of oxycyanate of mercury solution 1/4000. Both ureters appeared healthy. The bladder wall for the greater part appeared pale and healthy, but scattered irregularly over fundus and trigone were seen patches of submucous hemorrhages varying in size from a pin's head to a sixpence. The patches were of all shapes and sizes, some linear, some stellate. The greater number were scattered over the fundus. There was no ulceration and no sign of miliary tubercles. I came to the conclusion that I was either dealing with a purpuric condition of the bladder wall or that I had caught a primary blood infection of tuberculosis at its very onset.

On December 5th and again on the 6th a 24-hour specimen of urine was examined for tubercle bacilli and for pus cells. None were found. A "Von Pirquet" tuberculin reaction was done and was positive.

The urine remained clear till December 9, when another attack of pain and bleeding came on exactly similar to the first one. This lasted two days and then cleared up completely. Throughout the whole time the patient was in the hospital the temperature remained normal, and there were no signs of constitutional disturbance except that the patient felt below par.

15.12.10. No pain, no increased frequency, no blood for 4 days. Cystoscopy. The picture has changed completely. The bladder is quite healthy again save for three faint patches like fading bruises on the walls of the fundus. There is also a small fading patch of hemorrhage about one inch above the middle wall of the bar of Mercier into which a small blood vessel is seen to run and be lost.

16.12.10 Blood examination. Coagulation time 5 minutes. Red blood corpuscles 5,000,000. Hæmoglobin 85 per cent. Color index 0.8. White cells in normal proportions. Calcium lactate (10 grains three times a day) was administered for a week and the patient left the hospital on Dec. 19, apparently completely

cured and restored to health and has had no return of the bleeding up to date.

I regret I did not have the blood and throat cultures made and the coagulation times of the blood taken during the first week of the illness, but at the time I thought I was dealing with a case of tuberculosis of the bladder, and it was not till I had excluded this that I became convinced that the case must be considered as one of a purpura of the bladder mucous membrane.

This case is of interest from two points of view—that of urology and that of general pathology.

As regards the first, though many cases can be found in the literature of purpura accompanied by hæmaturia, yet I have been unable to find any case where cystoscopy has been performed and a description of the condition given, nor where the purpuric eruption has been proved to be confined to the bladder alone.

Urological literature is also full of unexplained cases of renal hæmaturia. Such cases may be mild single attacks or may be severe and relapsing, and certain authors have reported cases where one kidney has been removed for this condition and though submitted to minute microscopic examination nothing has been found to account for the bleeding. It is conceivable that some of these cases should be classed under the heading of purpuras in which the purpuric eruption has occurred only in the kidney. It seems fair to argue thus by analogy from the case just described where the purpuric eruption was proved to be confined entirely to the bladder. *Cystoscopy in the above case proved that an appearance may be met with in the mucous membrane of the bladder exactly resembling a purpuric eruption on the skin which clears up like a simple purpura and which may be unaccompanied by any other sign of hemorrhage either into the skin or into any other mucous membrane or part of the body.*

That a purpuric condition can reveal itself by means of intestinal pain and intestinal hemorrhage unaccompanied or not accompanied at first by purpura of the skin has been brought home by recent reports of cases of intestinal hemor-

rhages simulating or leading to intussusception. There is therefore sufficient clinical evidence to prove that an agent capable of producing a purpuric eruption can be circulating in the blood and can be thrown out into any single one of various situations, such as the intestine or bladder, without being thrown out into the skin at all.

The case is also of interest from the pathological standpoint. So long as the attempt was made to class purpuras on purely clinical grounds as separate entities so long the subject was in a state of confusion. A purpuric eruption, whether of skin or mucous membrane, must be considered as a symptom not as a disease. Such an eruption must be due to solutions of continuity in the walls of capillary blood-vessels with a result that blood escapes into the tissues.

When we inquire how this solution of continuity can arise we are not always able to detect a cause. When we cannot, we speak of primary purpuras, when we can we speak of secondary purpuras. We will discuss the secondary purpuras first.

The simplest cause is the mechanical weight of the blood which gives rise to that common form of purpuric eruption seen in those who rise from bed after a long illness. Again in patients who suffer from excessive blood-pressure such an eruption is sometimes seen. Certain chemical poisons are known to be able to cause such an eruption, as for instance chloral, iodoform, arsenic, quinine, the balsams, salicylates, potassium chlorate, mercury, phosphorus and lead; and the eruption of scurvy is probably due to a chemical alteration of the blood brought about by deficient ingestion of vegetable salts.

Again certain chemical poisons can arise within the body and give rise to purpuric eruptions such as have been described in nephritis, cirrhosis of the liver, in the cachexias, in pregnancy and in diseases of the blood.

But the most interesting group of all is that of the purpuras set up by the actions of micro-organisms or their poisons on the walls of the capillaries. Micro-organisms have been

found in purpuric lesions and it is well known that any of the acute specific fevers may be met with in a hemorrhagic form. But in many cases the eruption may be caused by the toxins of the bacteria as the bacteria have been found in the blood and not in the lesions, or have been found only in some local focus, as for instance in a diptheritic or streptococcal pharyngitis or in a local tuberculous lesion.

At first sight the eruption in this case appeared as though it might be a manifestation of the onset of tuberculosis; the "von Pirquet" tuberculin reaction was positive, and the case seemed to fit in very well with the descriptions of tuberculous purpura given by Bérard et Roubier, *Gaz. des Hospitaux*, 1907, lxxx, 1635–1671. They described three forms of purpura occurring in the course of tuberculosis.

1. A pre-tuberculous purpura which is the first sign of the onset of tuberculosis, hypothetically due to the circulation of tuberculin in the blood. In this connection it is interesting to note that a number of cases of tuberculous kidney have as an onset symptom a profuse painless hæmaturia.

2. A form of purpura which appears during the course of a frank tuberculosis and hypothetically due to secondary infection of the tuberculous foci.

3. A form seen during the terminal cachexia.

This hypothesis was rejected on the following grounds: no tubercle bacilli could be found in the urine, and the case has not gone on to tuberculosis of the genito-urinary tract. A second hypothesis seemed more acceptable, namely that the hemorrhagic eruption was due to the absorption of bacterial toxins from the throat. The child had a definite follicular tonsillitis on the left side and the glands of the neck were swollen and tender. Unfortunately no cultures were made of the throat. Certain bacteria have been proved to be capable of producing poisons which can cause hemorrhagic eruptions, for instance the streptococcus by Klein, the bacillus of Friedlander by Oliver, the typhoid bacillus by Andrewes. I have myself observed a case of erysipelas which proved fatal from hemorrhage into the stomach and duodenum. How does the

body eliminate bacteria and other poisons? The main channels are undoubtedly the kidney, the skin, the bowel, the liver and to a less extent the lungs. Originally the cœlom was the space into which poisons were excreted and were got rid of by means of the primitive nephridia.

The cœlom is nothing but a large connective space. Any large connective tissue space can apparently be made use of by Nature into which to pour out substances harmful to the body. In such spaces these bodies can be localized, diluted, neutralized and finally, when neutralized, be absorbed back into the blood as harmless substances. Such spaces are the joints, bursæ, serous spaces and aponeuroses and these may be looked upon as the " dustbins " of the body and by being used as such a second purpose is attained. Inflammation of such spaces may cause such pain that locomotion is impossible and recumbency is thus forced upon the victim of a severe infection.

Absolute recumbency is of the utmost importance in recovery from such an infection, as by that means it is possible to diminish the amount of poisons absorbed from the local focus, whereby the defensive mechanism of the tissues is not overwhelmed but is stimulated to produce sufficient antibodies to overcome the invading host.

In the same way it is tempting to think that the bladder may still retain traces of its origin. The bladder is developed from the allantois which was once part of the excretory organ of the fœtus.

It is permissible to suppose that in certain persons the bladder has not entirely lost its excretory function, and hence a bacterial poison circulating in the blood might be thrown out into the mucous membrane of the bladder and nowhere else. Anyhow such an hypothesis is a very tempting one.

If the hypothesis of a purpura secondary to a tonsillitis be rejected this case must be classed under one of the primary purpuras. Bérard and Roubier give three primary purpuras, namely purpura rheumatica, infective purpura and Wehrlof's purpura.

Purpura rheumatica is ushered in by prodromal symptoms,

malaise, pains all over the body and fever. These are soon followed by a purpuric eruption, joint pains and effusions, gastro-intestinal pains and hemorrhages, slightly albuminous and sometimes blood stained urine. The disease runs a course of from two to eight weeks and is followed as a general rule by complete recovery.

Infective purpura is of a severe typhus type and death is almost invariable.

Wehrlof's purpura is met with in children from five to fifteen years of age, chiefly in females. There are no prodromal symptoms, no malaise, no fever, no pains all over the body. Recovery is the rule. There is an acute form which is all over in a fortnight, and a chronic relapsing form which may last much longer. Hæmaturia has not been described.

The case reported above fits in most closely with the descriptions of Wehrlof's purpura, but seeing that hæmaturia has not been described in this form of purpura it does not exactly tally.

Summing up I am inclined to think that this case was one of secondary purpura confined to the bladder and arising in a bacterial infection of the tonsil though it is possible to look upon it as a case of Wehrlof's purpura.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, held at the New York Academy of Medicine, March 12, 1913.

President, Dr. Charles L. Gibson, in the Chair.

CHRONIC MASTITIS WITH CARCINOMA.

Dr. Parker Syms presented a woman, thirty-nine years of age, who gave the following history. About eight years ago, after the birth of her only child, she had "caking" of the right breast. There was no abscess. After this there remained a permanent localized swelling of the gland.

On December 31, 1912, she was admitted to Lebanon Hospital on account of this swelling and on account of the fact that there had been some recent increase in its size and some slight pain in the breast. When Doctor Syms examined her he found a typical condition of chronic mastitis or abnormal involution of the right breast with a distinct tumor in its upper outer quadrant.

Believing that such a condition is a precancerous state or at least is potential of cancer, and believing that it is impossible to make any differential diagnosis in these cases, Doctor Syms did the radical ablation of the breast, pectoral muscles and lymphatics after the method of Willy Meyer, on January 15, 1913.

The specimen was submitted to a competent pathologist who made sections of the same and reported the condition to be one of simple adenofibroma with no evidence of cancer. Some weeks afterward, at Doctor Syms request the same pathologist made many sections of the specimen and finally he ran across one from which he made the diagnosis of cancer.

Doctor Syms said that he presented this case as one of particular interest and of great value because it emphasizes certain important points.

First, it emphasizes the fact that this condition of abnormal involution or chronic mastitis (with the production of masses, which histologically may be classed as fibro-adenomata or adeno-fibromata) is a very important factor in the development of cancer and must therefore be considered as a precancerous condition or stage.

Second, it illustrates the fact that in these cases cancer may begin in one part of the gland while such a change may not be found in any other part of the gland.

Third, it emphasizes the fact that the detection of such a cancerous change may require the examination of many sections.

Fourth, this being true, it is evident that diagnosis by means of the frozen section must be subject to error in a certain proportion of cases.

Doctor Syms has always maintained that reliance on the frozen section is not justifiable in these cases. In this particular case examination of several sections of the hardened specimen in the laboratory failed to reveal the carcinoma. How much less reliable would have been a hastily made examination of a frozen section!

TUBERCULOSIS OF THE BREAST.

Dr. John A. Hartwell reported the case of a married woman, twenty-three years old, a native of Roumania, who gave no family history of either tuberculosis or cancer. She had one child, eighteen months old, which she had nursed for one year. Six weeks ago she first noticed a large, hard lump in the right breast, which at one time was markedly reddened and extremely tender. This was treated at a dispensary with a binder and massage, and had gradually decreased in size. About two weeks ago she began to have pain in the wrist and legs, about four inches above the ankle joint. These areas became red and tender; she felt feverish and was unable to walk because of the pain. During the past fortnight she had been unable to do her housework, and had suffered from marked anorexia. Her chief complaint was swelling in the right breast, and swelling and pain in both legs between the middle and lower thirds.

Examination of the joints and skin showed a rheumatic inflammation, which apparently had no connection with the breast lesion. There was no evidence of tuberculosis in the lungs or

other organs aside from the right breast, which was the seat of a subacute, inflammatory process involving the whole inner quadrant, the mass thus formed measuring about 10 x 15 cm. in extent. The overlying skin was reddened, and at one point near the nipple it was on the verge of ulcerating. On palpation, the mass was irregular in outline; it involved the breast tissue in its entire thickness, and was adherent to the skin but not to the muscle. In consistency it varied from a very hard, inflammatory character to a fluctuation at the point where the skin was most reddened. There were areas of boggy swelling scattered through it, which were quite tender in some parts; in others, non-sensitive. There was one moderately enlarged gland, slightly tender, in the axilla.

The patient objected seriously to a complete removal of the breast, and accordingly, only the diseased area was removed. Primary union followed. The enlarged gland in the axilla was not excised, and a month after the operation it was no longer palpable.

Upon gross examination it was found that the excised portion of the breast was the seat of a chronic inflammatory process, with several small, suppurating foci. There were no evidences of cheesy necrosis: in parts, the exudate was of an almost stony hardness, but in many it was quite soft. The area immediately beneath the most inflamed point in the skin was broken down into an abscess, with moderately thick pus and ragged, necrotic walls. The clinical history of the case and the gross appearance of the specimen suggested tuberculosis, but a positive diagnosis was not possible. Microscopic examination, however, showed typical miliary tubercles, with giant cells and central necrosis. Section stained for tubercle bacilli demonstrated the organism.

BILATERAL CYSTIC DEGENERATION OF THE BREASTS.

Dr. W. S. Schley presented a woman, single, fifty-two years old, who was admitted to the hospital on February 16, 1908, complaining of trouble with her breasts. Examination showed that the breasts were rather small and flattened, firm, non-tender, and both contained numerous small and large nodules. A number of the larger ones were punctured and a clear fluid was withdrawn.

While the process was recognized as essentially a benign one, the possibility of overlooking a cancerous cyst was con-

sidered. Both breasts were removed by the old marginal incision —sometimes called Thomas's incision—preserving the nipple and integument in compliance with a request for a cosmetic result. The appearance of the breasts was very good from that standpoint, and the scars were scarcely appreciable.

DIFFUSE ADENOFIBROMA OF BOTH BREASTS.

DR. SCHLEY presented a woman of forty-five who was admitted to the hospital on February 27, 1913. She was married, but had had no children. Her mother died at the age of fifty-eight with "cancer of the glands of the neck."

The patient complained of some hardening of the left breast, with occasional stabbing pains and some swelling. Her observation of the condition began three weeks before her entrance to the hospital, when she noticed that the breast seemed slightly swollen and tender, but without redness or signs of inflammation. Upon examination, the left breast showed marked thickening of the tissues under the nipple and in the lower and outer quadrants, with slightly fuller outline. This area was moderately tender. There was no retraction of the nipple nor palpable axillary glands. The feel was that of matted and enlarged glandular elements, and a diagnosis of adenofibroma was made. Frozen sections at the time of operating confirmed this diagnosis, and a full third of the breast was removed.

The right breast showed a similar condition, but the area of induration was more limited. Nothing had thus far been done with this breast, but the patient was being kept under observation.

Dr. Schley said the practical questions to decide in dealing with benign conditions of the breast was in which of them were malignant changes likely to occur, which could be treated by local excision, and which were better off with removal of the breast? Most of these patients were over 40 years of age, a time when we looked for malignant changes. The simple cystic conditions, with single or multiple cysts, were distinctly benign and required only local excision unless associated with adenomatous hyperplasia or the parenchymatous hypertrophy of Bloodgood. Adenomatous changes, whether of the adenomafibroma or the adenocystic type, were suspicious, even if the epithelium had not dipped beneath the basement membrane, and if associated with parenchymatous hypertrophy to any extent, the removal of the

breast was wise. We had come to a more careful gross differentiation of breast tumors, with or without the aid of frozen sections, which had led to a somewhat more conservative surgery. We should not place too much reliance on the frozen sections, even if they were nearly perfect, as the excised portion may not have come from the particular part where the epithelial changes existed. Over-conservatism might be even more undesirable than radicalism, and a combined surgical and pathological experience in gross as well as microscopic anatomy was necessary in the conservative handling of breast growths. In doubtful cases the removal of the breast was certainly advisable, as none could gainsay the ultimate safety thus assured. After partial excision, cysts and adenomata sometimes developed in the remainder of the gland. Bloodgood, in 1909, declared that he had never seen cancer develop in any of the breasts treated by local excision at the Baltimore clinic.

EPITHELIAL CHANGES IN CHRONIC MASTITIS, AND THEIR RELATION TO THE DEVELOPMENT OF MAMMARY CARCINOMA.

DR. BURTON J. LEE read a paper with the above title.

DR. HARTWELL said the paper of Dr. Lee was most timely in more than one respect, as it definitely called our attention to a condition which actually existed, and to the changes which took place in the transformation of benign into malignant lesions. Every pathologist was aware of this fact and the frequency with which it was overlooked in surgical work. Dr. Hartwell said he had recently reviewed the subject of cancer for a paper which he was writing, and he had found an appalling number of cases which were seen by clinicians or surgeons, who had temporized with them in spite of the fact that they were already malignant or soon afterward became so.

In dealing with a chronic mastitis, the possibility of a malignant change was especially important. In the case of Dr. Hartwell's, reported by Dr. Lee, the breast was evidently the seat of a chronic mastitis, but there was one area, not localized, but quite hard and very suspicious of carcinoma. He did a radical operation, and Dr. Ewing examined many sections without being able to prove that it was carcinoma. He reported that it was a

chronic mastitis with changes that would have gone on to carcinoma. Subsequently, he found evidences of actual carcinomatous changes. In the other breast a focus which was positively malignant was also found.

There was no question, the speaker said, that breasts of this type should be removed in their entirety, as they offered a beautiful illustration of an inflammatory condition undergoing malignant degeneration.

Dr. Schley, speaking of tuberculosis of the breast, said that in a review of the subject in 1903 he had found 304 cases recorded in the literature. Since then perhaps twelve or fifteen more had been reported. Dr. Powers, of Denver, in his last article, reported two new cases, and Dr. Schley said he had recently seen two in which the breast infection was secondary to tuberculosis of the ribs. The infection in these cases was either hæmatogenous or by way of the lymphatics or nipple. Dr. Powers had only seen four cases in his own experience and Dr. Brill had seen one or two. In most of these cases a spontaneous cure was unknown.

Dr. Chas. L. Gibson said that changes in the epithelium in the carcinomatous age indicated a very dangerous condition, and such conditions at any time were likely to become malignant. After the age of 35 or more, a disturbance of the breast, due to epithelial changes, should be held to be cancerous until proven to be otherwise. It was better to occasionally sacrifice a healthy breast than to allow a woman with a cancer to go unoperated. That, Dr. Gibson said, was the position which he took in his paper on the subject which he read before this Society a number of years ago.

Dr. Lee, in closing, said in reply to a question that while the precancerous condition might be recognized in frozen sections, the difficulty was that such sections were usually taken from one area of breast tissue, whereas sections from different areas should be carefully examined before we could positively exclude precancerous changes or true carcinoma.

UNDESCENDED TESTIS IN A HERMAPHRODITE.

Dr. George Woolsey reported this case and showed the specimen. The patient was a seamstress, twenty-four years old, a native of Austria, who was admitted to one of the female wards

at Bellevue Hospital on March 4, 1913, with the diagnosis of hernia. Upon examination Dr. Woolsey found a small tumor in the region of the left pubic spine, which the patient said she had first noticed about two weeks before when she suddenly leaned forward at work and pinched it causing severe pain. On February 24 the pain had become so severe that she had to go to bed, and she had remained there until the time of her admission to the hospital. It gave the peculiar ovarian or testicular tenderness on pressure, and had not increased in size. The tumor gave no impulse on coughing and it was regarded at the time as a hernia of the left ovary. Upon operation, the tumor proved to be a small testis, curled on itself, and upon further exposure the vas deferens was traced up to the inguinal canal, which contained no hernal sac. There was no scrotum into which the testis could be transplanted, and it was thereupon removed.

The external genitals of this patient, including the vestibule, meatus and clitoris, Dr. Woolsey said, were those of the female type, with a much enlarged clitoris. The vagina was smaller than normal, the vaginal portion of the cervix was lacking, and both by vaginal and rectal examination and by combined examination, with one finger through an opening in the peritoneum at the internal ring, no uterus could be felt. A transversely placed structure, feeling like the organ removed, could be felt in the pelvis on the right side of the upper end of the vagina. On either side of the upper end of the vagina could be felt a cord like structure. The vas was traced in to the pelvic brim but it was not possible to palpate its further course.

At the time of the patient's admission to the hospital, her face had the appearance of that of a man's with a dark beard, closely shaven, and at the time of operation there was a distinct growth of hair on the face. This was removed from time to time by rubbing with some kind of stone. The chest was covered with quite a profuse growth of hair. There was no development of the breasts. She had never menstruated, but at varying intervals she had noticed a slight whitish discharge from the vulva, lasting but a few minutes and preceded by a peculiar sensation.

The specimen was reported on by Dr. James Ewing, as follows: "This specimen may be described as an undeveloped but otherwise complete testis. The testicular tissue forms an excapsulated, brownish mass, one-half by one cm. in size, which

is attached to a larger mass of fibro-cellular tissue, one by two cm., which contains portions of epididymis and rete testis. On section, the testicular tubules are normal in form and arrangement, though small in size. There are scanty interstitial cells in the stroma. There is no evidence of spermato-genesis. The tubules of the epididymis have normal, large, high, cylindrical, ciliated epithelium. There are many ducts lying in the dense fibrous tissue and containing pus. The surrounding connective tissue is very cellular and extensively invaded by plasma cells and lymphoid follicles."

The patient must therefore be regarded as a male pseudo-hermaphrodite.

Stated Meeting, held at the Presbyterian Hospital, March 26, 1913.

The President, Dr. Charles L. Gibson, in the Chair.

PYOPNEUMOTHORAX.

Dr. John A. Hartwell presented a man, twenty-three years old, who had an attack of pneumonia in 1910. Aside from this there had been no past illness of importance, and there was nothing to indicate a tubercular infection. He was admitted to the Presbyterian Hospital early in December, 1912, having been sick for six days with the symptoms of pneumonia on the right side.

On admission, the patient looked acutely ill. His breathing was shallow and painful, and he suffered from a severe cough, with dirty brown expectoration. His temperature was 102°; pulse, 102; respirations, 28; leucocytes, 31,600, with 93 per cent. of polynuclears. The physical signs over the right chest were those of a pyopneumothorax, and they were confirmed by aspiration, both pus and air being withdrawn through the exploring needle. No tubercle bacilli were found in the sputum or in the pus, the latter showing long chain cocci in smears, but no growth on culture.

In the absence of any evidence of tuberculosis, and in view of the acute onset, it was believed that the pyopneumothorax followed either a pneumonia or an abscess of the lung. A free

opening into the pleural cavity under these circumstances for the purpose of drainage would inevitably result in the complete collapse of the lung, and with the existing perforation in the lung there would be little tendency for the latter to expand, and a chronic empyema would result. Therefore, instead of free drainage, the pus was repeatedly aspirated at intervals of twenty-four hours, and the air was continuously withdrawn by means of a large hollow needle introduced above the fluid line, connected with a tube which was immersed in water in a bottle standing on the floor. By these measures the pleural cavity was kept practically empty, because on coughing any air that was pumped from the lung into the pleural cavity was immediately expelled through the needle and escaped under the water. The water valve prevented aspiration into the chest through the needle. When first inserted, there was a positive pressure which forced air out in considerable quantity; the pressure then sank to zero, and air only flowed when coughing.

The pus aspiration and the equalization of the air pressure was kept up in this way for one week, during which time the patient's general condition was much improved, the temperature, pulse and respirations dropping to normal. During the last three days of this period there was much of the time a negative pressure shown in the chest cavity by the sucking of the water up into the tube for a distance of ten cm. or more. This demonstrated that the perforation in the lung was growing smaller, and that some expansion of the lung was possible.

Under local anæsthesia, half an inch of the eighth rib was resected in the axillary line, and a self-retaining rubber bobbin was inserted through a small hole in the pleura. A tube was passed through the bobbin and connected with the suction bottle. In this way all of the pus was withdrawn, much of it having been too thick to flow through the needle, and the suction expanded the lung without evidence of opening, to any extent, the hole in the lung. By means of the snugly fitting bobbin, air was prevented from entering the chest through the pleural opening, and a clamp on the tube closed this means of entrance. Each day suction was applied to the tube, and in the intervals the tube was kept closed. The chest was thus kept empty of pus, and a certain amount of negative pressure maintained which resulted in a gradual expansion of the lung. All evidence of air passing

into the pleura from the lung ceased in about two weeks, and thereafter the condition was treated by simple drainage. Four weeks after the operation the discharge had entirely stopped, and the wound was completely healed.

From the physical signs it seemed that the expansion of the lung was very incomplete, but there was no evidence of either fluid or air in the pleural cavity, and suppuration had entirely ceased. The patient's condition was satisfactory at the present time, two months after leaving the hospital.

This method of treatment, Dr. Hartwell said, had been followed in a second case of pyopneumothorax following pneumonia, with an equally satisfactory result. The principle underlying it was that the chest cavity was not opened until the perforation in the lung was sealed, and during the interval required for this, the mechanical compression of the lung and the ill-effects of the suppuration were minimized by the negative pressure maintained and the frequent withdrawal of the pus. Presumably, the closure of the lung perforation took place by its becoming adherent at the site of the opening rather than by an actual healing, though the latter took place subsequently. It was impossible, however, to completely clear up the infection by simple aspiration, and ultimately a thoracotomy had to be done, but the principle of suction had to be maintained even then.

TUBERCULOSIS OF THE KIDNEY: NEPHRECTOMY.

Dr. Hartwell presented a man, twenty-seven years of age, who was admitted to the Presbyterian Hospital on December 11, 1912. He had suffered from symptoms of cystitis for eleven months, and about five months ago the diagnosis of a left-sided tuberculous kidney was made, and tubercle bacilli were demonstrated in the urine. At the same time he was told that he had a tuberculous process in the apices of both lungs, and for that reason he was advised against operative interference. He grew progressively worse as far as the urinary symptoms were concerned, and on admission was suffering constantly and severely from the cystitis.

Examinations with the cystoscope and the X-ray confirmed the diagnosis of the kidney lesion, but there were no definite signs of pulmonary tuberculosis.

A nephrectomy was done on December 20, 1912, through a

straight incision outside of the spinal muscles. The left kidney was found to be almost completely destroyed with tuberculosis, there being a cheesy abscess in each calyx. The ureter was found to be dilated and markedly diseased as far as it could be followed through the existing incision, a distance of five inches. It was divided at this point with the actual cautery. A large probe was passed into the bladder, insuring the patency of the ureter, and then the cauterized end was ligated with catgut. The patient's condition was such that it was thought inadvisable to submit him to the added operation of removing the entire ureter, and it was hoped that with drainage into the bladder and the absence of fresh infection from the kidney, the ureteral infection might be taken care of.

Following the operation, the patient's course was satisfactory and the wound gradually healed. The cystitis, under local treatment, improved markedly. The man left the hospital in about seven weeks, having remained a month after the operative wound healed, for the bladder treatments. It was now three months since the operation and his general condition was excellent, there having been a gain of thirty pounds in weight. The bladder condition, too, had steadily improved, and now he had almost no subjective symptoms of the cystitis excepting slight pain at the end of micturition, which was not unduly frequent. About two weeks ago, however, the wound in the back broke down and has since remained open. At the present time there is a sinus, presumably leading to the ureter, which is lined with typical appearing tuberculous granulations.

In view of his marked general improvement and the steady progress of the bladder lesion towards recovery, was it advisable to temporize in dealing with the sinus, or should the remainder of the ureter be removed at once?

ENTEROSTOMY FOR INTESTINAL OBSTRUCTION FOLLOWING ACUTE APPENDICITIS.

DR. HARTWELL presented a girl, five and a half years old, who was admitted to the Presbyterian Hospital on October 15, 1912, with a well developed appendicular abscess of five days' duration, this being her first attack. Her past history was uneventful and she had always been a child of normal intelligence and mental activity. The routine physical examinations showed

nothing abnormal excepting the usual signs of an abscess in the right lower abdomen. There was no evidence of either tuberculosis or syphilis.

An immediate operation was done, and a small abscess with a chronically inflamed appendix was found. The appendix was removed, ligating and cauterizing the base, but not inverting it. A small double tube drain was placed in the abscess cavity.

On the second day following the operation the child developed signs of intestinal obstruction. This was thought to be a paralytic ileus, but it failed to respond to the usual remedies, and at the end of the third day an enterostomy was done by opening through the left pararectus line and inserting a small tube into the first presenting coil of small intestine through a small stab-wound, which was surrounded by a purse-string suture.

Following this procedure, the patient's condition was satisfactory, the intestinal drainage being free and the obstructive symptoms subsiding. Three days later, methylene blue given by the mouth did not appear in the enterostomy wound until the ninth hour; the discharge, however, was that from the upper intestine, and there was a very considerable digestion of the skin. After the seventh day the fecal discharge from the enterostomy wound grew progressively less, and there was some fæces passed per anum. Gradually this increased in amount, and the amount of discharge through the enterostomy wound became very small, so that the skin healed up and only one dry pad a day was required to keep the parts clean. The child's general condition, however, was very unsatisfactory. She ate only fairly well, and there was very rapid and severe emaciation until she appeared like a child in the advanced stage of starvation. She was very restless, irritable and mentally depressed, and after two weeks she developed a bronchopneumonia which lasted about a fortnight. Her condition was strongly suggestive of pulmonary tuberculosis, but no bacilli could be found and the signs in the lungs gradually cleared up without improvement in her general condition. Her mentality was very unsatisfactory: at times she was excessively irritable or she might lie for hours in deep apathy. The condition was somewhat suggestive of a tubercular meningitis, but thorough examination of the eye grounds, the spinal fluid and the skin reaction all yielded negative results.

On November 25, seven weeks after the enterostomy, and

five weeks after the wound had almost closed, although there was always some discharge through it, the patient developed a condition resembling catalepsy; she refused to respond to questions and stared with dilated pupils, apparently taking no interest in her surroundings. This attack came on in the morning, shortly after breakfast, and at ten minutes past one in the afternoon she began to have localized convulsions of the right arm and face. The clonic spasms seemed to be of the cortical type, as they were both flexor and extensor in character. The pupils were widely dilated, immobile, with a horizontal nystagmus with the quick component to the right. There was marked twitching of the facial muscles, with winking of the lids and slight frothing at the mouth. The convulsions followed closely one after another, and were somewhat relieved by the inhalation of small amounts of chloroform. A lumbar puncture was done at 1.45 P.M., and twelve c.c. of clear fluid was withdrawn under moderate pressure, but without relief of symptoms. Dr. M. Allen Starr saw the case at 2.10 P.M., and considered the condition due to a cerebral embolism of a septic nature originating from either the appendicular abscess or the pneumonia. The convulsions lasted almost without interruption until five o'clock, and could only be controlled with chloroform. They were confined to the right side.

The child gradually recovered from the convulsions and on the following morning was again in the condition noted earlier in her illness, but with a marked increase in the mental apathy and irritability. No response could be obtained from her, and she seemed to have lost entirely her association with her surroundings. She failed to recognize her parents, and at times both they and the nurses and staff thought she was suffering from sensory blindness and deafness.

On November 30 another series of convulsions occurred, lasting one hour and confined to the left side. From this time on the child's condition was pitiable. In no way could she be aroused to take any notice of her surroundings, and at times she would suffer from violent hallucinations and cry out in fright, covering her face with her hands and pleading to be saved from imaginary injuries. She was emaciated and feeble. Her appetite was very capricious; what was eaten was apparently well digested, and practically all fecal matter was passed per anum,

there being very little discharge from the enterostomy wound, though always some. Repeated examinations of the eye grounds, the spinal fluid and blood and complete physical examinations failed to show any evidence of organic lesion nor of tuberculosis or syphilis.

On December 22, the condition having continued the same, she was seen by Dr. Theodore C. Janeway, who offered the suggestion that possibly the loss of calcium salts and other nutritional disturbances due to the high enterostomy might be causing the malnutrition and the cerebral unbalance. On the following day, despite the very small discharge through the enterostomy wound and despite the wretched condition of the patient, the intestinal opening was closed. The child stood the operation well, and immediately following it the administration of calcium lactate was begun. The operative wound healed kindly, with only superficial suppuration, and the patency of the intestinal canal seemed normal. Her convalescence from that time on was perfectly satisfactory, and within two weeks she was entirely normal and rapidly gaining weight. At the present time she appears in every way like a robust child of six years, being quite up to the average both physically and mentally.

Unfortunately in this case, Dr. Hartwell said, no studies were made of the metabolism during her illness, but if the malnutrition and particularly the loss of calcium due to the high enterostomy did not bear a causal relation to the symptoms exhibited, then her improvement when these factors were corrected was a most curious coincidence. At any rate, the subject was worthy of serious experimental study.

Dr. Hartwell expressed his indebtedness to Dr. Eliot, on whose service these cases occurred, for the privilege of reporting them.

RHINOPLASTY BY FINGER.

Dr. Clarence A. McWilliams presented a man, forty-five years old, who was admitted to the Presbyterian Hospital on September 5, 1912. Two years before, while working as a stationary engine oiler, his right arm was caught in a belt and his face was drawn in so that it was struck by the spokes of the wheel, annihilating his nose. He was taken to the Long Island City Hospital, where he spent a year and submitted to eleven operations.

When the patient was admitted to the Presbyterian Hospital, his face was entirely healed, but greatly disfigured and scarred. The nose, including its nasal and cartilaginous portions, was entirely missing, as was also the projection of the frontal bone forward. There was a single small opening into the nasal cavity, admitting a probe. The left nostril was entirely gone; its edge was attached to the bone underneath, while one-half of the right nostril remained and projected forward in a teat-like process. The defect in the soft parts extended up to within one inch of the frontal bone, and measured one inch in its transverse diameter and an inch and a half vertically. Any plastic operation to reproduce the nose in such a case necessitated the use of some bony support. Morestin had carried out a procedure of grafting a rib into the soft parts of the forehead, and then turning down a flap, containing the implanted rib, to form the nose. This did not seem advisable here because of the scars on the forehead, and the disinclination to augment the disfigurement by additional scars, and it seemed a more feasible plan to graft a finger into the defect. The man's condition was pitiable; he could get no position because of the deformity, and went around with a handkerchief tied about his face to hide his disfigurement.

The operative procedure followed by Dr. McWilliams in this case was that described by Finney and McGraw. The patient's head and shoulders were immobilized in a plaster-of-Paris splint the evening before the operation, and this splint was then cut down on one side so that it could be quickly removed in case of any accident during anæsthesia. This splint proved of great assistance in immobilizing the attached hand and arm immediately after the operation. A knife inserted into the defect separated the soft parts from the bone beneath, the incision being extended up to the frontal bone and the edges of the defect were pared all about the margins. As a graft, the left ring finger was chosen. After applying an Esmarch bandage about the arm, the nail of the left ring finger was removed and the tissues scraped away until the bone was exposed. The metacarpophalangeal articulation was then opened by a posterior longitudinal incision, the posterior extensor tendon was divided, the joint opened and the head of the metacarpal bone removed. After division of the anterior tendons and the lateral ligaments of the joint, the finger was free, but was still united to the soft parts and nourished by the uninjured digital vessels. The skin was removed from the

entire circumference of the distal phalanx, and the tip of the phalanx nipped off with the rongeur. The finger was then slipped into place, the extremity of the last phalanx extending up to the frontal bone under a bridge of undivided soft parts. No suture was used to attach the phalanx to the frontal bone. A longitudinal denudation was made on each side of the second phalanx, about one-fourth of an inch wide, to which the edge of the cheek on one side was sutured and on the other that of the nostril, the defect between the cheek and nostril being filled in by the skin from the dorsal surface of the finger. The first phalanx was left unattached, as it was later to be turned backward. Interrupted silkworm sutures were used. A plaster-of-Paris splint was then applied about the head, arm and chest.

For two days after the operation the pain in the arm was severe; after that the arm, so to speak, fell asleep, and there was no further discomfort. On the fifteenth day after the operation one of the digital vessels on one side of the finger was tied under 4 per cent. novocain anæsthesia, and six days later the finger was amputated through the metacarpophalangeal articulation, using novocain locally. No attempt was made to close the proximal end of the finger at the time. Heat, in the shape of hot cloths, was applied to the finger for twenty-four hours. Subsequently there was some necrosis of the soft parts at the end of the first phalanx, but not to any great extent.

Eight days later the first phalanx was flexed to a right angle with relation to the second phalanx, and its tip was sutured in this position to the bone behind, while the soft parts covering it were also turned backward and sewn to the freshened lower border of the nasal defect. Sixteen days later it was necessary to remove the greater part of the first phalanx on account of necrosis. After this operation there was some infection of the finger, the pus from which escaped through several points in the line of the scars. This infection, however, was soon controlled. The tendons of the transplanted finger were not disturbed at any time during the various procedures, and were still in place.

At the present time, while the man is still far from handsome, his appearance is vastly improved over what it was prior to the operation. There is no evidence, now three months after the operation, of any regrowth of the nail. There was a small opening into the nasal cavity, but not sufficient for respiration.

The man was a mouth-breather and had very little sense of smell.

The wound caused by amputating the finger healed by primary union. The tip of the last phalanx seemed to be solidly united to the frontal bone. During the 21 days that the finger remained attached to the face and hand, the patient's nourishment was restricted to fluids and administered through a tube passed into the angle of the mouth. At the outset of the operation, it was planned to wait but fourteen days before amputating the finger, but at the expiration of that time the patient was so comfortable that it was deemed safer to wait another week.

ARTERIOVENOUS FEMORAL ANASTOMOSIS (LATERAL TRANSVERSE) FOR THREATENING GANGRENE.

DR. MCWILLIAMS presented a man fifty-three years old, a physician, who lost the last two phalanges of the second left toe, in 1903, by gangrene. Six years ago Dr. McWilliams amputated the right leg at the junction of the upper and middle thirds for a gangrenous condition of three toes which extended up on the foot for two inches. At that time he realized the danger of the stump not healing, but decided to run the risk of doing a low amputation, in view of the fact that the man was dependent for his living on having as serviceable a limb as possible. There had never been the slightest trouble from this stump, and the left foot remained free from further disturbance until two years ago, when the stump of the second toe became painful. Subsequently, the end broke down and has remained unhealed until the present time, being covered by an indolent crust. In November, 1912, the stump of the second toe became discolored and very painful. Two months later the pain had extended to the third, fourth and big toes, which also became dusky and tender. There was also intense pain and discoloration over the instep, and considerable œdema of the foot, gradually diminishing up to the ankle-joint. Walking was impossible, and a most striking feature was the icy coldness of the extremity.

The patient entered the Presbyterian Hospital on February 10, 1913, expressing the hope that anything be done except an amputation. An end-to-end vessel anastomosis has been performed in a number of these cases, but the disadvantage of this method was that, if anything went wrong with the anastomosis, then the gangrene was made much worse. Dr. McWilliams

thereupon resolved to try the lateral anastomosis, which Bernheim, of Johns Hopkins, had done eleven times with his transverse method. The speaker said he realized the possibility of an arteriovenous aneurism developing, but this had not occurred in any of Bernheim's cases.[1] It did not seem reasonable to expect that there would be any improvement in the stump of the second toe, the vessels of which were probably almost completely occluded, but it was hoped to get enough blood down to the foot to obviate the threatening gangrene in the foot and the other toes. The result of the operation entirely justified this reasoning. If amputation should later become necessary through the failure of the anastomosis, then it was hoped that enough blood would get down into the leg to assure the success of the amputation. The fact should not be lost sight of that the arterial blood also has to overcome the valves in the veins.

On Feburary 11, 1913, Dr. McWilliams anastomosed the femoral artery and vein laterally, according to Bernheim's method, making a transverse incision with a small cataract knife through one-third the diameter of the artery. The anastomosis was made three inches below Poupart's ligament, just underneath a visible valve in the vein, the artery being situated in front of the vein. Four Crile carotid artery forceps were first applied, above and below the orifice. The opening in the vessels, by the action of their longitudinal fibres, at once became oval. The walls of the artery were twice their normal thickness, and its lumen was small. The contained blood was immediately washed out with salt solution, and liquid vaseline was smeared inside and outside their lumina. An oiled, continuous, fine silk suture was then passed, with the knots outside, uniting the edges. The vein was ligated permanently, proximal to the anastomosis. After removal of the Crile clamps there was no leakage. The pulsations were seen and felt to go down the vein as far as the latter could be followed in the incision. The wound healed primarily.

For five days after operation the pain was agonizing, requiring the use of considerable morphia. The most striking change noted was in the temperature of the foot, which became normally warm. The patient was kept in bed for fourteen days.

[1] Bernheim: Jour. of the American Med. Ass'n., Feb. 1, 1913, page 360. ANNALS OF SURGERY, Nov., 1912; also Feb., 1912.

and left the hospital on March 1, 1913. By that time the œdema had entirely disappeared and thus far it has not returned, even after walking. There was also a disappearance of the tenderness and pain in all of the toes, save in the stump of the second toe, which has remained tender and painful. There is now no popliteal pulsation to be felt. Over the site of the anastomosis one can hear a thrill with the stethoscope.

In connection with this case, Dr. McWilliams raised the query whether it would be advisable to remove the stump of the second toe. Would the wound heal or not? In cases of threatening gangrene the method seemed worthy of trial, but where gangrene had already set in to any degree, it was useless to do it, for the vessels were impervious. It might, however, permit one to do a lower amputation than was usual.

As to end-to-end *versus* lateral anastomosis, the speaker added that Wieting, of Constantinople, who had done considerable work in this field, had come to the conclusion that a lateral anastomosis ought to be the method of choice, and he himself now restricted himself to that method.

ILEUS FOLLOWING GANGRENOUS APPENDICITIS WITH GENERAL PERITONITIS.

Dr. McWilliams presented a boy, thirteen years old, who was admitted to the Presbyterian Hospital, in the service of Dr. George Woolsey, on August 16, 1912. A median suprapubic incision was made by Dr. Woolsey, the appendix was removed, a large amount of free pus evacuated, and two cigarette drains introduced into the right flank. The operation was followed by excessive distention of the abdomen, which was unrelieved by enemata, and three days later Dr. McWilliams punctured the cæcum in the wound. This afforded great relief, and the peritoneal irritation soon subsided. On the fifteenth day the boy awoke with pain in the left abdomen; he vomited and there was again marked abdominal distention which could not be relieved by enema. His pulse, which had been practically normal, went up to 120, and on the following afternoon he had two convulsions.

Operation by Dr. McWilliams, eighteen hours after the onset of the pain: On account of the fulness in the left iliac fossa, an incision was made through the left rectus. Numerous adhesions between the intestines were encountered, with several col-

lapsed coils of gut in the right pelvis. Upon following these up, he came upon a band encircling the gut, which was dilated proximally. Upon separating the adhesions, gas was observed to enter the collapsed gut. The wound was thereupon closed, and, at the completion of the operation, fæces were passed through the colostomy opening.

Following this operation, all the patient's symptoms subsided. Within a few days fæces were passed per rectum as well as through the colostomy wound, which showed no inclination to close. The fecal discharge through this wound produced severe irritation of the adjacent skin, and the boy was losing weight. A month later Dr. McWilliams tried to close the fistula by dissecting it free and inserting a double row of Lembert sutures: these failed to hold and the condition was as bad as ever. Two weeks later he did a more radical operation, dissecting out the fistula and putting in three rows of Lembert sutures. These evidently puckered the intestine too much, as their insertion was followed by pain, vomiting and distention, and no movement of the bowels. Two days later he punctured the intestine in the wound and after two weeks he did a final operation, opening the right rectus above the cæcostomy opening and anastomosing the small intestine (just proximal to where it entered into the mass of adhesions in the right iliac fossa) to the transverse colon by means of a Murphy button placed in the sides of the two coils. To insure union a continuous silk suture was inserted around the button. No drainage. Following this there were no further unfavorable symptoms, and the fistula permanently closed at once. The case illustrates the value of an artificial anus in presence of paralysis of the bowel from sepsis, and also the difficulty which may be met with in closing it. Probably in the majority of cases the anus will close of itself.

PYLOROPLASTY FOR PERFORATING DUODENAL ULCER.

Dr. A. V. S. Lambert presented a man, thirty-five years old, a letter carrier, who gave a history of stomach trouble dating back for five years, and characterized chiefly by epigastric pain and distress and eructations of gas coming on an hour or two after eating. Four hours before his admission to the Presbyterian Hospital he had a severe, sharp, lancinating pain in the epigastrium while he was making his rounds delivering mail. He had taken no food for several hours previous.

At the time of his admission, he complained of intense abdominal pain. Examination showed retraction and pronounced rigidity of the abdomen, more or less generalized. His general condition was excellent; his temperature was normal; there was no leucocytosis. At operation an ulcer was found about a quarter of an inch beyond the pyloric vein on the anterior surface of the duodenum. This was punched out and was surrounded by a moderate amount of induration. The ulcer was excised, and a pyloroplasty, as described by Finney, was done.

For 48 hours following the operation the patient vomited considerably, and his stomach was washed out every twelve hours. The contents of the stomach were dark brown. A diastasis of the upper recti developed, and a secondary closure of the wound was done on the fourteenth day. His further recovery was uneventful and he has been free from symptoms since.

ŒSOPHAGO-GASTROSTOMY FOR CARDIOSPASM.

DR. LAMBERT presented a woman, forty years old, who was admitted to the medical division of the Presbyterian Hospital on April 10, 1912, with the diagnosis of carcinoma of the stomach and a history of persistent vomiting and progressive and marked loss of weight. The vomitus consisted of the food just taken, unchanged. A test meal showed 190 c.c. of thick fluid, with mucus, acid in reaction. No free hydrochloric acid; considerable lactic acid and some blood, with many bacilli resembling the Boas-Opler bacillus.

The patient was transferred to the surgical division on April 16 and an exploratory laparotomy was done, which showed that the stomach was normal. The appendix was removed. Following this operation there was no abatement of the symptoms. and ten days later the patient was sent back to the medical ward, where on May 1 the diagnosis of a dilated œsophagus with cardiospasm was made with the X-ray after the ingestion of bismuth. She was again sent to the surgical division, and as her weight had fallen to 74 pounds a gastrostomy under cocaine anæsthesia was done. Frequent attempts were made to have the patient swallow a string, but these were all unsuccessful. Dr. Stevens finally succeeded in passing a string upward through the cardia via, the gastrostomy opening, by means of a cystoscope, and Dr. H. H. Janeway, with the aid of the œsophagoscope, drew this string upward out through the mouth. Plummer apparatus

was then readily passed through the cardia which was dilated, but without resulting benefit. This failure to give the patient relief from dilatation was believed to be due to the course of the œsophagus, lying as it did on the surface of the diaphragm, and the point of its entrance through the diaphragm being situated above the lowest part of the pouch.

On February 1, 1913, an œsophago-gastrostomy was done. An L-shaped incision was made in the median line, with extension to the tip of the tenth rib. Through an incision over the seventh rib beneath the breast the seventh, eighth and ninth ribs were fractured, and a flap turned backward and upward. The left broad ligament of the liver was divided, and the gastrostomy opening separated from the anterior abdominal wall. The stomach and spleen were then dragged downward which gave a ready access to the cardia. The diaphragm was divided to the left of the œsophagus; the left pleura, which was accidentally nicked at this point, was closed by suture. The œsophagus was then loosened from its attachments to the pericardium, diaphragm and aorta, and the findings of the X-ray examination confirmed by palpation. A stiff bougie was then passed down the œsophagus and impinged against the diaphragm, well to the right and posterior to the point where the œsophagus passed through the diaphragm. The portion of the œsophagus situated below the lower end of the bougie was then pulled into the abdomen, and the diaphragm was sutured to the œsophagus at the point where the bougie was intercepted. A large clamp was then passed into the stomach through the gastrostomy opening; one blade of this was passed into the œsophagus through the cardiac opening while the other blade remained in the stomach in such a manner that, when the clamp was closed, there was included between its two blades a portion of œsophagus and a portion of the greater curvature of the stomach or cardia. A few interrupted sutures approximated the œsophagus and stomach about the closed clamp. A rubber tube drain was inserted alongside of the anastomosis. The gastrostomy opening was brought to the abdominal wall and the clamp was left *in situ*.

During the first ten days of the patient's convalescence she had a left-sided pleurisy. The clamp was tightened on the fourth day, and removed on the eighth day. The patient was given liquid food by the mouth for 28 days, when the tube was left

out of the gastrostomy. She was able to take solid food by the mouth on the 33d day. She had lost some weight after the operation, which she has since regained. There was occasional regurgitation of food, but this is becoming less frequent.

Dr. Willy Meyer said there were a certain number of cases of cardiospasm that were intractable and did not yield to stretching, and demanded operative interference. The case shown by Dr. Lambert was interesting in that the obstruction was attacked from below and that sufficient space was obtained to do an anastomosis. Dr. Meyer said it had been his good—or bad—fortune to meet with three of these cases within the past few years. In one of these, a woman, where it was found impossible to enter the cardia and dilate the œsophagus, he did a thoracotomy and after loosening the pouch he made a double plication of its anterior wall. The patient made a good convalescence and spontaneously regained the ability of swallowing fluids and later solids. Subsequently, she developed, after an acute pneumonia, an œsophageal fistula in the thoracotomy scar, and finally died from an infection of the posterior mediastinum. She had no difficulty in swallowing up to the end. In the second case practically the same method was followed, but a single plication made. In the third case there was a slight stricture of the cardia, most likely following a peptic ulcer.

In the second case the first operation was followed by only temporary improvement, and six weeks ago Dr. Meyer did a second thoracotomy, cutting out a large aperture in the chest wall in order to gain access to the part. Dense adhesions in the posterior mediastinum prevented a good exposure of the œsophagus. The œsophageal foramen of the diaphragm was incised and an intrathoracic cardioplasty done, after the method of Heinicke-Mikulicz at the pylorus. The patient made a good recovery and his ability to swallow was much better than it was before the operation. The speaker said he did not know whether the case would go on to complete recovery, but the point he wished to emphasize was that we could treat the cardia in much the same way as we could the pylorus. The approach to the cardia was certainly easier through the thorax than through the abdomen.

Dr. Lambert, in closing, said the clamp was chosen in this case because it seemed to offer the better safeguard to preventing the contents of the œsophagus from entering the pleural cavity

and the mediastinum. The cavity produced by the dilated œsophagus always contained very foul-smelling material, and it was thought that if the anastomosis could be made from the abdomen, the clamp would serve its purpose until adhesions had formed. The rather adverse reports that had followed the intrathoracic method in operating on these cases had decided them to go in from below.

SACROCOCCYGEAL CYST.

Dr. George Woolsey presented an infant, who, when admitted to the hospital, in May, 1912, was nine days old. The mother stated that five months before giving birth to the child she had received a blow over the abdomen, which apparently gave rise to no symptoms. The labor was normal, the child was put to the breast and for the first three days it nursed well and was free from symptoms. Then vomiting set in and became almost constant.

When Dr. Woolsey first saw the child, six or seven days after birth, there was a swelling in the sacrococcygeal region, which pushed the scrotum and anus forward and pressed against the subpubic arch. The swelling was apparently a cyst, and upon aspiration, a clear, yellow fluid was withdrawn. Two days later the legs and lower abdomen became swollen. The cyst was again aspirated and four ounces of fluid withdrawn, but this produced no effect on the swollen parts, which became cyanotic. The vomiting still persisted; the bowels were obturated and the child was unable to void urine.

Operation, May 9, 1912: Upon incising the cyst, several smaller cysts were found to project into it from the deeper surface. The largest of these extended upward into the abdominal cavity between the rectum and sacrum, pressing on the iliac veins. About eight ounces of fluid were withdrawn, and part of the redundant outer wall of the cyst resected. Following this operation, the venous congestion and swelling of the legs and abdomen immediately disappeared, and the child was able to void urine and defecate. The vomiting also ceased. The child's convalescence was practically uneventful, and it was discharged on May 17, 1912. Up to the present time, there had been no recurrence of the cyst. There was some redundance of the skin over the buttocks, which was much scarred by stitch abscesses. Since the operation, the child had grown remarkably well.

BILATERAL CALCULOUS PYONEPHROSIS.

DR. WOOLSEY presented a woman who had already been shown by him at a meeting of the Society on November 22, 1911 (ANNALS OF SURGERY, vol. lv, page 450). She was forty-nine years old at the time when she was admitted to the Presbyterian Hospital on July 17, 1911. She then gave a history of having had mild attacks of pain in the right kidney region for twenty years prior to March, 1896, when she was operated on at Bellevue Hospital, where three stones, including a large, pipe-stemmed one, were removed from the right kidney. The kidney consisted of a thick shell, containing several large pus pockets. Her pain persisted, and an X-ray showed stones in both kidneys. A right nephrectomy was planned, but a ureteral catheterization showed that the right kidney was apparently the better of the two. In November, 1906, the patient was again operated on, this time at the Presbyterian Hospital, where one stone, the size of an olive pit, and several smaller ones were removed from the right kidney. At this time two small pockets of pus were opened, and the kidney was drained. On the 6th of the following month the left kidney was opened, and three or four calculi removed. This kidney was found to be much enlarged and adherent, and filled with pockets of thick, greenish-yellow, foul-smelling pus. After this operation a sinus persisted for nearly a year. The wound on the right side had healed rapidly, and the patient gradually gained in strength.

After the above operations the patient had occasional slight attacks of pain in the right lumbar region, and eight days prior to her readmission to the hospital she was seized with a sharp, severe pain over the old wound on the left side, followed by the appearance of a hard but not very tender mass. On the day of her admission this swelling broke and, with the spontaneous evacuation of a large quantity of greenish pus, her pain ceased. An X-ray showed stones in both kidneys, more pronounced on the left side, and there was also a stone in the left ureter at the brim of the pelvis. In the middle of the left lumbar scar there was a small sinus discharging yellow pus, without urinous odor. On bilateral examination a mass twice the size of the kidney was felt in the left upper quadrant; it could be pushed forward from behind, was firm and smooth and not very tender.

On July 28, 1911, Dr. Woolsey opened the old scar, evacuat-

ing three pockets of pus and partly freeing the kidney from adhesions, but these were so dense that he was unable to deliver it into the wound. The kidney was thereupon incised, and with some difficulty several phosphatic stones were removed, one the size of a robin's egg, and two of bean size. The abscess seemed to be outside of the kidney, which was very much altered, and reduced to a thick shell. The wound was closed, with drainage.

The patient made a good recovery. The amount of pus in the urine gradually decreased, and under the use of urotropin the reaction of the urine first became neutral and then acid. The wound was closing well and draining considerable urine, and the patient was able to leave for home on August 11, 1911. At the time it was planned to remove the ureteral calculous at some future date, if necessary.

The patient was readmitted to the hospital on February 26, 1912, and two days later Dr. Woolsey exposed the left ureter, which was enlarged to the size of an adult's thumb, with thickened walls. Midway between the pelvic brim and the bladder there was a dark, rough, flattened stone, about one cm. long, which was removed, and two inches below the kidney pelvis two smaller stones were encountered and removed through separate incisions, which were closed by suture. On April 10, 1912, an abscess, about the size of an orange, in the upper pole of the right kidney, was incised and drained.

At the present time (March, 1913), the patient states that she has not felt so well for ten years. Two sinuses persist in the left lumbar scar. One of these, apparently, was kept open by a fragment of rubber tubing which was removed five days ago under local anæsthesia.

This patient, Dr. Woolsey said, was presented again at this time as an example of subjective good health in spite of two greatly damaged kidneys, either one of which would naturally have been removed as useless. The X-ray showed no stones in the kidneys or ureters, for the first time in years.

SPLENECTOMY FOR BANTI'S DISEASE.

Dr. Joseph A. Blake presented a woman, forty-five years old, born in Russia, and a housewife by occupation. The history she gave was that three years ago she had a pain in her upper left abdomen. This was sudden in onset and sharp, lancinating

in character. It persisted about a month and confined her to bed for three weeks. She then remained free from pain until about one year ago, when it recurred in the same location, but this time it assumed more of a dragging character and extended to the left side of the back and the left lower extremity. She had occasional attacks of vomiting, and the pain had persisted, more or less, up to the present time. Three weeks ago, following a heavy meal, she had a sudden attack of faintness; she was hungry for air and looked very pale. Following this attack she vomited three times in the course of two hours, and on one of these occasions the vomitus was very profuse and contained much clotted and fluid blood. For a day or two after this attack she passed dark material (blood?) in her stools. There was no further history of hæmatemesis or melæna. During the past few years she had gradually lost flesh and strength, her weight having decreased perhaps 40 pounds. The patient gave no alcoholic history. Her appetite was good; the bowels regular; no diarrhœa. She had been married for 26 years and was the mother of four healthy children. No miscarriages.

Upon admission to the hospital, the patient was thin and sallow. The superficial lymph nodes were not enlarged. The abdomen was full and rounded, and moved easily with respiration. There were no enlarged veins; no peristalsis. The spleen could be felt one inch to the right of the midline and one inch below the umbilicus, and its edge could be felt indefinitely in the posterior axillary line. Its surface was smooth; there was no tenderness nor rigidity.

An examination of the blood gave 2,060,000 red blood cells, 5,800 white blood cells, 58 per cent. of polynuclears and 45 per cent. of hæmoglobin. The stools were examined repeatedly for occult blood, with negative results. On the 28th day after admission an examination of the blood showed 2,800,000 red blood cells, with 65 per cent. of hæmoglobin. During this time the patient had a slight temperature, varying from 99° to 100°, and she had had one attack of pain in the left upper quadrant, of several hours' duration. There was no resistance nor rigidity.

The case was regarded as one of splenic anæmia, and a splenectomy was done on the 29th day after admission. The spleen was found to be of immense size and attached to the posterior and lateral abdominal walls and to the diaphragm by many

vascular adhesions. There were numerous tortuous veins in the splenic pedicle. No thrombo-arteritis was made out. The hemorrhage during the operation was severe.

On the day following the operation the blood showed 2,450,000 red blood cells, 24,000 leucocytes, 79 per cent. of polynuclears and 50 per cent. of hæmoglobin. The temperature, which had gone up to 103°, gradually fell to 100°. There was considerable pink oozing through the stab-wound drain. The pulse ranged between 115 and 130. The patient's convalescence was slow, but gradual, and on the 35th day after the operation a blood count showed 3,200,000 red blood cells, 16,000 leucocytes, 74 per cent. of polynuclears and 65 per cent. of hæmoglobin. Her general condition was improved, and there was less abdominal pain each day. She was able to take a little exercise and expected to go to the country.

The spleen, when removed, measured 21 x 18 x 8 cm. Its contour was preserved, its surface being covered in places by organized adhesions. Microscopically, its capsule was found to be thickened, there was an increase in the connective tissue framework, with a marked decrease in the Malpigian bodies. The splenic pulp showed a marked increase in connective tissue reticulum caused by the flushing out of the spleen after its removal. The sinuses appeared empty. There were no evidences of multinuclear cells or epithelioid cells. Section through the splenic artery showed definite thickening of the media; the vein was normal. Diagnosis: Splenic anæmia; perisplenitis.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting held March 3, 1913.

DR. GWILYM G. DAVIS, President, in the Chair.

TOTAL EXTIRPATION OF THE EXTERNAL GENITALIA FOR CARCINOMA.

DR. E. HOLLINGSWORTH SITER presented a patient in whom a total extirpation of the external genitalia for carcinoma had been done.

SUBDIAPHRAGMATIC ABSCESS.

DR. DUNCAN L. DESPARD read a paper with the above title, for which see page 334.

DR. JOHN H. JOPSON said that it had been his misfortune to see a good many cases of subphrenic infection, including cases following appendicitis, ruptured gastric and duodenal ulcers, operation for cholecystitis, and one case of probable kidney infection,—12 cases in all, with a mortality of 58 per cent.

Appendicitis is probably the most frequent cause of subphrenic infection in this country, although it frequently follows the accident of perforating gastric or duodenal ulcer. Appendicitis is easily the most frequent cause in children, as was shown in his study of all the reported cases up to 1903.

Some distinction should be made between subhepatic and subphrenic abscesses, because the symptoms of the latter are often more characteristic. Several times in subphrenic infection he had found an early inflammation of the pleura present, as shown by pleuritic pain, friction rub, fine râles and an early involvement of the lung. In many cases of true subphrenic abscess, however, these symptoms are transient or absent, as are nearly all of the classical symptoms detailed by Dr. Despard. A persistently high temperature and the physical signs of a

collection, large or small, usually on the right side, are sometimes the only symptoms present. In one young child under his care rapid emaciation was a striking symptom. In some cases physical signs suggesting subphrenic abscess are apparently present and no abscess exists. A few weeks ago there was such a case at the Presbyterian Hospital which was studied very carefully by both the medical and surgical men and also by the radiographer. All signs pointed to a pleural effusion. The patient had had perforative appendicitis followed by high fever, and all agreed upon a probable diagnosis of subphrenic abscess. Aspiration and subsequent abdominal exploration were both negative and proved this diagnosis to be wrong.

In another case in which the patient was demonstrated at operation to have a large collection of pus in the subphrenic region an X-ray was taken before the operation, and the radiographer denied the possibility of a subphrenic collection, but after operation, acknowledged that he had failed to read his plate correctly. We must, therefore, acknowledge that X-ray pictures in this condition require very careful study and expert interpretation, and even then, may be deceptive; but they should be taken in all suspected cases, as they will in time undoubtedly furnish us valuable information as to the presence of such collections.

Dr. George G. Ross said that it had been his experience that subdiaphragmatic abscess is due more often to inflammations of the vermiform appendix. He remembered one case due to perforative gastric ulcer which was of the anterior subdiaphragmatic variety. He thought the appendix gives rise more often to infection of the subhepatic space, but when it occupies a position behind the cæcum the direct line of infection is toward the subdiaphragmatic space, largely on account of the arrangement of the psoas-iliacus muscle which gives a distinct upward flow to the infection when the patient is recumbent. His attention was called to this subject by an occurrence at the German Hospital in which in one week there were four cases of subdiaphragmatic abscess in patients operated on for appendicitis.

Dr. Astley P. C. Ashhurst said that he had gone carefully over the case reports, and found that only an exceedingly small number were what should be called true subphrenic abscesses; the vast majority were what are properly described as subhepatic abscesses or abscesses of the kidney pouch. The incision

in these cases was made over the appendix, and whenever pus was found running up toward the liver the case was classed as one of subphrenic abscess. It is correct to distinguish between these cases and those of true subphrenic abscess. If he were to add to his relatively small number of subphrenic abscesses the large number of cases of appendicitis in which at operation he had found pus extending up toward the liver he should have a very large number of subphrenic abscesses with a very low mortality, instead of a few cases with about the average mortality.

A subphrenic abscess in the left region of the diaphragm he had seen only in one case of a child of two years, at the Children's Hospital in the service of Dr. Hutchinson, in 1906: this apparently was the result of tuberculous peritonitis. The abscess had discharged at the umbilicus before the child was admitted to the hospital; with Dr. Jopson's assistance he explored the sinus, but a fecal fistula developed within a week, and the child died about a month later.

As to pleural effusion as a valuable sign in the diagnosis of subphrenic abscess, a patient with stab-wounds of the liver on whom he operated last year for Dr. Frazier at the Episcopal Hospital developed thoracic signs during convalescence; but although his chest was tapped on several occasions at the point indicated by the consultant (Dr. Geo. W. Norris) no fluid was found at any time, nor did he have any other evidence of subphrenic or hepatic abscess. He carried a septic temperature for a long time, and all the physical signs of pleural effusion were present, but he finally recovered.

Dr. Despard has spoken of the danger of infecting the pleura in doing a transpleural operation for drainage of a subphrenic abscess, and while no doubt this danger is greater in cases of subphrenic abscess than in cases of hepatic abscess yet if the technic is proper the danger he believed was overestimated. Dr. W. W. Ashhurst had a large experience in these operations when he lived in Mexico, and devised the following technic: after subperiosteal excision of the rib selected, a curved needle is passed through both layers of the pleura in the costo-phrenic sinus and is made to penetrate the diaphragm; the fact of penetration is ascertained easily by the sensation when the needle catches in the diaphragm. A row of such sutures is inserted along the upper margin of the space left by excision of the rib, and not

until the intact pleural cavity is in this way isolated from the operative field are the deep layer of the periosteum, the contiguous layers of the pleura and the diaphragm incised. In this way the chance of infecting the pleura is very remote.

Dr. Despard remarked, in closing the discussion, that the belief that subdiaphragmatic abscesses are more usually due to the appendix, is true if only applicable to the subhepatic fossæ, but if all the subdiaphragmatic areas are considered statistics will show that perforating ulcers of the stomach or duodenum are the most frequent cause. The subhepatic fossa is the site of an abscess truly subdiaphragmatic for it rests upon the right crus of the diaphragm and is limited above by the right lateral ligament of the diaphragm.

In regard to the case spoken of as not having been drained, the evidence of infection in this region at the time was not sufficient to justify drainage. At the autopsy this abscess was found to be both intra- and extraperitoneal, involving the upper pole of the right kidney and the under surface of the liver. It was probably imperfectly drained through the anterior wound, so that the pus did not accumulate in sufficient quantities to give such definite physical signs as would justify exploration.

How this extended to the point above the kidney is uncertain, but probably by means of the retroperitoneal lymphatics. He suggested this differential point, lumbar or postcæcal abscesses are entirely different from subdiaphragmatic abscesses and are often due to imperfectly drained appendiceal infections; none of his cases were of this variety or in this situation.

TUMORS OF THE CAROTID BODY.

Dr. John Chalmers DaCosta presented a specimen of a carotid tumor which he removed several months ago. The patient was a woman of thirty-six years of age. The growth began 16 years ago, was very slow for many years but during the last 6 months it has grown more than it did in the previous 15½ years. The tumor is about the size of an English walnut. The diagnosis was made in this case before operation. The very slow growth for years, the carotid pulsation which lifted the tumor at every beat of the artery, the absence of expansile pulsation, the free movement from side to side, the absence of mobility

from above downward and from below upward indicated a tumor of the carotid gland.

A few years ago he made a report of a case of tumor of the carotid gland upon which he had operated. In that case he was obliged to tie the common carotid artery and as a result of the ligation hemiplegia developed. He stated on that occasion that he would never again remove one of these growths, a statement which is proof of the truth of the saying of James Russell Lowell, that "one should not prophesy unless one knows!" In spite of that prophecy he now reported another case. There are very few cases of carotid tumor on record, 32 altogether. The mortality has been 25 per cent. and in 6 of the cases there was recurrence. In several of the more recent cases it was found possible to remove the growth without tying the common carotid.

Again, these growths when they begin to show rapid enlargement have become malignant and if let alone will produce death. He determined to operate on this patient and succeeded in getting the gland out of the carotid bifurcation without tying the common carotid, although he was forced to tie the external carotid. The pathological report shows that the growth is a perithelioma.

MYXOCHONDRO-ENDOTHELIOMA OF OCCIPITAL BONE.

Dr. Da Costa presented an enormous tumor which he had removed from the nasopharynx of a colored woman aged twenty-four years. The pathological report shows it to be a myxo-chondro-endothelioma. It was so large that it filled the entire back of the throat and between it and the dorsum of the tongue it was not possible to pass the handle of a spoon laid flat. The woman was in immediate peril of suffocation. This growth had lasted for 6 years. He performed a preliminary tracheotomy and a few days afterward tied each external carotid artery and explored to see if he could possibly remove the growth without serious mutilation of the patient. It was necessary to remove the right half of the upper jaw, because the growth had invaded the posterior part of the antrum. The growth sprang from the basilar process of the occipital bone and had fused with the palate bone, the soft palate and a part of the superior maxillary bone on the right side. The removal was accomplished with difficulty and in spite of the carotid ligation occasioned severe hemorrhage.

LACTEAL CYST OF BREAST.

Dr. Da Costa presented a specimen being a huge milk cyst of the breast. He said that it was the second one he had ever seen. The previous one, which was much smaller, was in the service of Professor Keen. This growth did not start during pregnancy nor lactation, at least if it did the woman never noticed it, but it began six years after a child birth. It grew slowly, was free from pain, troubled her only from its weight, and felt soft, as though it ought to fluctuate, but there was no fluctuation. As one pressed upon it it suggested thick walls with fluid beyond them. There were many large veins in the skin of the breast. There was no discharge from the nipple and there never had been.

On opening into this it was found that the entire breast was converted into a grayish yellow mass of the consistency of butter. Macroscopically there was no breast tissue remaining. Therefore, he removed the gland. Chemical tests showed that it contained products from milk and a study of it proved it to be a typical galactocele, the breast being practically completely destroyed.

ACUTE SPONTANEOUS PERFORATION OF THE GALL-BLADDER INTO THE FREE PERITONEAL CAVITY

Dr. George G. Ross reported the history of a case of perforation of the gall-bladder into the free peritoneal cavity due to ulceration of the gall-bladder walls, as follows: Woman, age sixty-three years. In childhood had measles. At thirty-three years of age had catarrh of the bowels, during and immediately following which she had malaria which lasted one year. During malarial influence she had a chill every other day but did not go to bed. About this time (33rd year) she had indigestion so bad that she ate only "starch" and "camphor," eating about a pound of washing starch daily and now and then camphor.

In April, 1912, she was suddenly seized with a severe pain in the epigastrium which lasted about one day leaving her tender and sore for one week afterwards. On May 13, 1912, there was another attack of very severe and excruciating pain in the lower abdomen. Three days prior to May 13 she had complained of marked abdominal soreness, but the sudden pain

on May 13 seemed to be a climax. This pain was accompanied by nausea and vomiting, constipation and a diminished amount of urine. This lasted until Wednesday, May 15.

Monday, May 13, the temperature was 99 degrees, pulse 84 and respiration 12. The very slow respirations were said to be due to morphin sulphate. As time went on from Monday, May 13, to Wednesday, May 15, the abdomen continued to become more and more distended and the urine smaller in amount and of redder discoloration. Tuesday, May 14, during the morning she again had a very sudden, severe and excruciating pain in the lower abdomen which also radiated to the shoulder and back. Wednesday morning, May 15, the abdomen became greatly distended and was quite tender and sore and more or less painful, but the pain was not so severe as during the previous few days. There were no peristaltic sounds audible. The urine was diminished in amount. The bowels had not moved and she had not passed flatus.

Operation, May 15, 1912. An incision was made in the right upper rectus close to the semilunar line. On opening the peritoneum the abdominal cavity was found to contain free fluid, of the appearance and nature of bile. The "bile" spurted from the wound on incising the peritoneum. In the pelvis was found a cloudy, bile-stained fluid. The gall-bladder was perforated and had discharged its bile content and 10 or 12 stones into the abdominal cavity. About 250 gall-stones of greatly varied sizes, the majority of which were small, split-pea size and the largest of which was about 1.50 x 2.00 x 0.75 cm., were removed from the gall-bladder. The gall-bladder "rupture" occurred on the inferior surface near the cystic duct. The gall-bladder mucosa was inflamed and the wall thickened. There were fine adhesions in many places. The bile ducts were patulous. A rubber drainage tube was sutured to the gall-bladder wall entering the bladder. There was no attempt made to sew up the rent in the gall-bladder. A small puncture was made in the hypogastrium and a rubber catheter inserted into the pelvic cavity, for drainage purposes. The peritoneal cavity was not washed out, the excess of bile being mopped out with gauze sponges.

May 15. White blood cells 10,000.

May 22. Culture of fluid from ruptured gall-bladder showed staphylococcus and streptococcus and bacillus coli

It is quite evident that the organism found in the gall-bladder and peritoneal cavity were of a low state of virulence as the peritonitis was of a distinctly low grade, there being little or no lymph deposit and the cloudy, bile-stained fluid found in the pelvic cavity was not true pus.

Patient made an uneventful recovery, going home with a small fistulous tract to the gall-bladder.

Since preparing the report of the above case a second case was admitted to the Germantown Hospital, which Dr. Ross saw in consultation with Dr. Wm. N. Johnson to whose ward the patient was admitted.

The patient was a man, forty-seven years of age who three days before admission was seized with pain in the lower right side of the chest. This pain was made worse by a cough, which was dry, and unproductive, or by deep inspiration. For five days before this severe pain in side, patient had been coming to the medical dispensary complaining of a feeling of weakness—general vague pains, headaches, constipation, loss of appetite and restlessness at nights. Gives no history of nausea, vomiting or chills.

When admitted the abdominal wall was rigid. The distention was marked. The abdomen was so tender that palpation was painful (the weight of an ice water bag causes pain to be increased). Lower liver margin could not be felt. At a point over the gall-bladder area the tenderness was more pronounced.

The patient died the second day after being in the ward. The following are the notes taken from the autopsy report:

"Lungs, heart and pleura normal; abdominal cavity contains a large quantity of free, greenish pus; intestines distended, highly inflamed and covered with exudate; omentum matted together in the region of the pylorus and gall-bladder; gall-bladder contains a few ounces of pus; a large gall-stone found in the cystic duct; perforation (ulcerated through) in cystic duct through which pass bile and pus; dome of the liver up as high as the third rib; pancreas, spleen, kidneys and appendix normal."

Dr. John H. Gibbon asked what are the causes of rupture of the gall-bladder outside of ulceration from stone and traumatism. He had had such a case and had no idea what caused it; he expected to find a stone but on opening the abdomen there was a lot of free bile in the peritoneal cavity and the gall-bladder was

full of bile. The head of the pancreas was quite hard; there was no stone. There was no difficulty in examining the pancreas, the ducts or the duodenum; and the patient was made quite comfortable by drainage. The gall-bladder was red and inflamed but there was no pus, just bile, which was seeping from the gall-bladder wall.

Dr. Astley P. C. Ashhurst called attention to the question of biliary peritonitis without perforation of the bile-ducts, and referred to the cases reported in 1906 to this Academy, in which was found bile-stained peritoneal effusion without any apparent cause. In one case the appendix was removed and the patient got well; in another simple drainage was employed and the patient died. In the first case the yellow color of the effusion was shown on examination not to be due to bile, but to "disorganization of the coloring matter of the blood." Recently he had seen an article on biliary peritonitis without perforation of the bile-tract, putting on record several cases in which operation was done. In one case, just as in the case which Dr. Gibbon has mentioned, the bile could be seen oozing through the walls of the gall-bladder even after they had been wiped dry. In none of these cases was the fluid examined to see whether it was really bile, but it may be presumed that it was in Dr. Gibbon's case, and in the similar case where it was seen oozing through the walls of the gall-bladder. In the case reported by Clairmont and Haberer (*Mitth. a. d. Grenz. d. Med. u. Chir.*, 1910, xxii, 154) the common duct was obstructed by stone, but the gall-bladder appeared healthy. These observers made a number of experiments on dogs for another purpose, but involving obstruction of the choledochus, and found in a small proportion of cases, in 3 cases out of a large number of experiments, that peritonitis occurred with bile-stained effusion, but without perforation of the bile-tract. Other cases encountered at operation have been reported by Schievelbein, by Johansson, and by Wolff. It has been suggested by Schievelbein that this filtration of bile may be due to the presence in the gall-bladder of structures known as "Luschka's Gänge." These are mucous canals extending to the subserous tissue of the gall-bladder, and are said to exist only in about 3 per cent. of cases. Schievelbein claims that inflammatory changes in the gall-bladder wall destroy its permeability. It is, therefore, only when the unusual coincidence arises (1) that

these canals are present; (2) that acute obstruction occurs in the presence of a nearly normal gall-bladder, that biliary peritonitis can occur without perforation of the bile-tract. This theory, however, fails to explain cases like those reported by Dr. Davis, where the fluid was shown not to be bile, but altered blood.

While the post-mortem discoloration of neighboring parts by the bile is well recognized, it does not facilitate the explanation of such a change during life.

Dr. Gwilym G. Davis said that the cases reported by him some years ago in the Annals of Surgery were carefully studied and the liquid was examined; the coloring matter was found to be hemoglobin.

Dr. John H. Jopson said that he had operated on two cases of perforation of the gall-bladder into the general peritoneal cavity. One of these which was reported before the Academy of Surgery in 1904 was in a woman of fifty-one, sick for 48 hours with gall-stone colic, but the perforation was probably not over 6 or 8 hours duration. There was a single stone in the first portion of the cystic duct, and the site of perforation, while not determined exactly, was near the cystic duct. This patient recovered.

In the second case which was in an elderly woman the perforation was of much longer duration, probably 36 hours or longer; the patient came to operation in bad shape suffering from sepsis and exhaustion and afterward succumbed.

THE RELATIONSHIP BETWEEN GASTRIC AND PANCREATIC CARCINOMA.

Dr. Edward A. Schumann read a paper with the above title for which see page 326.

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